THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVI. No. 1703.] LONDON, DECEMBER 31, 1895. [47TH YEAR. PRICE 6d.

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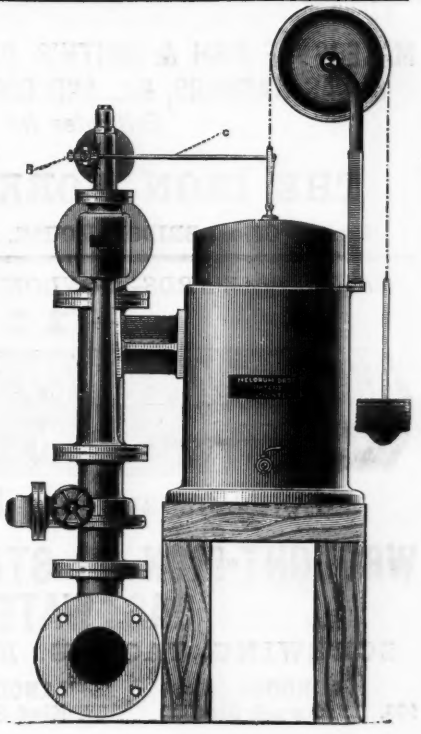

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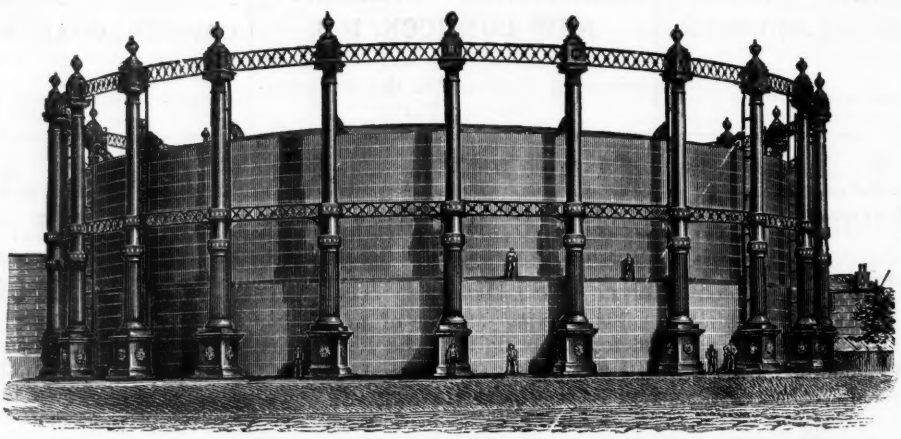

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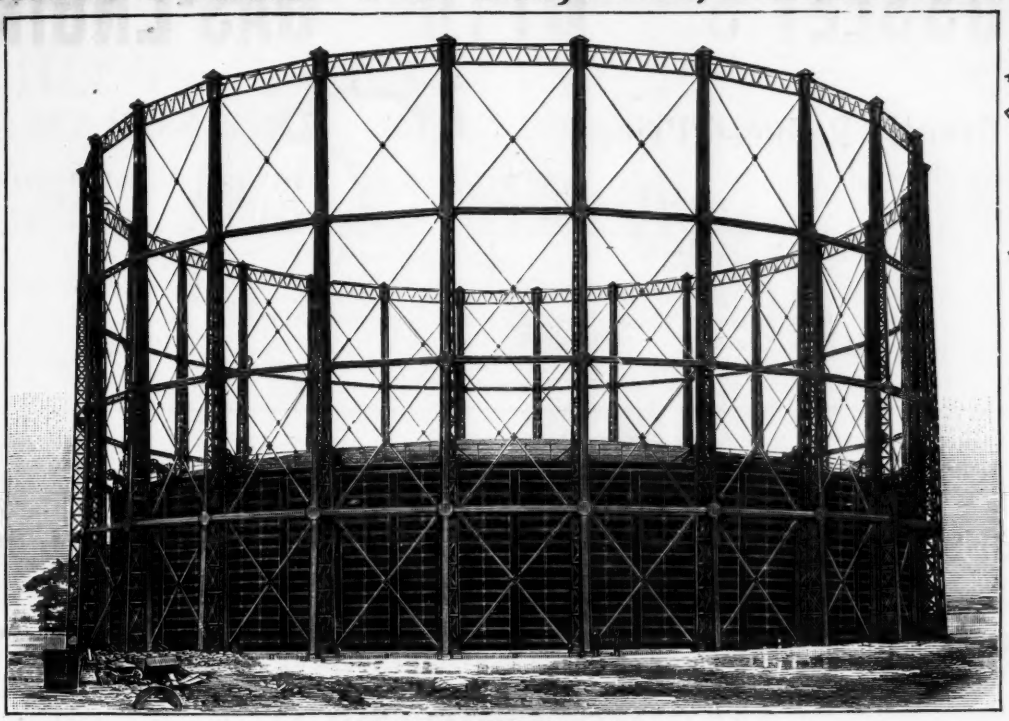

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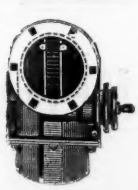

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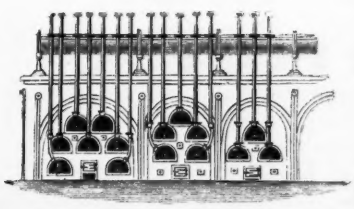

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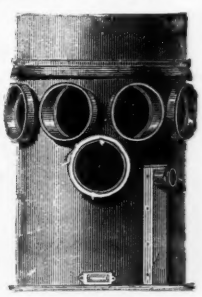

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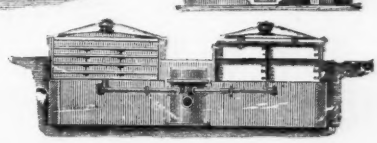

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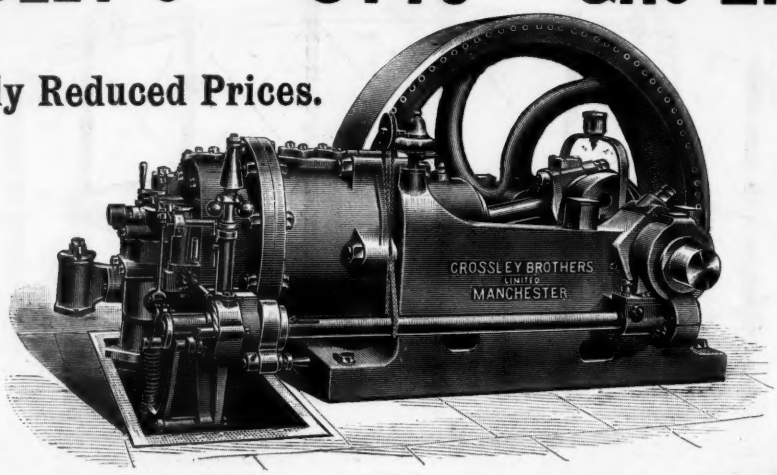

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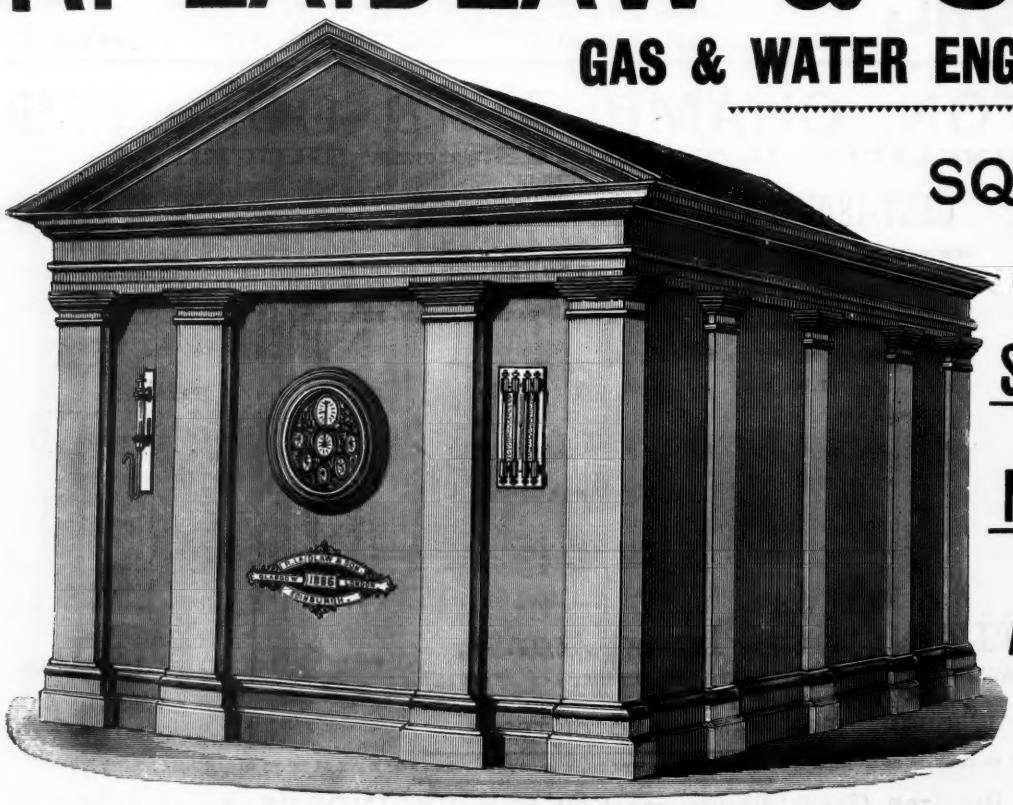

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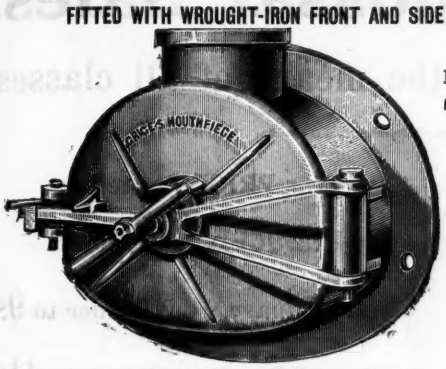

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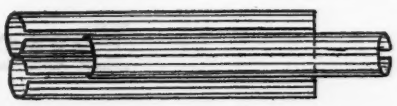

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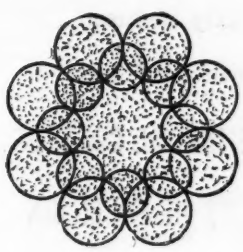

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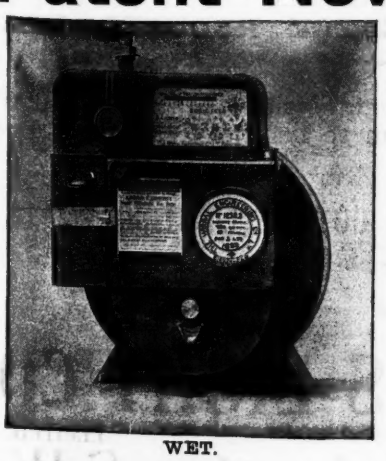

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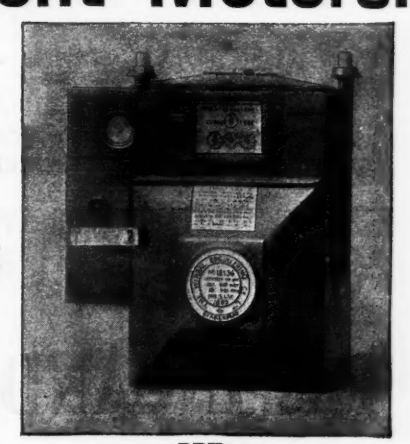

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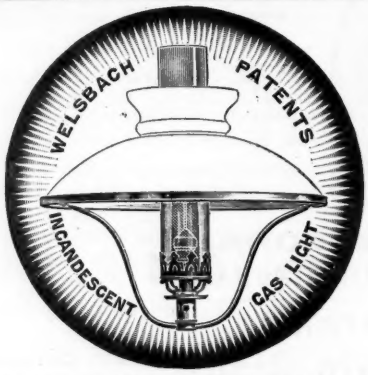

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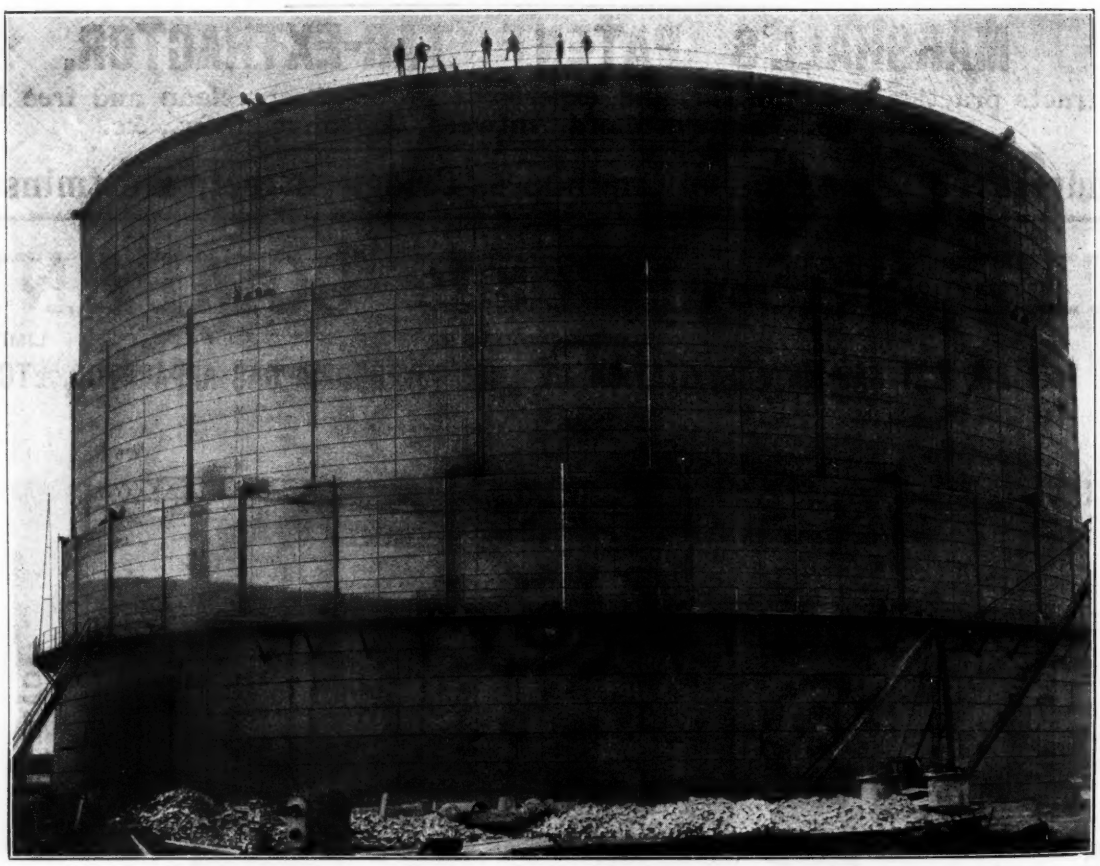

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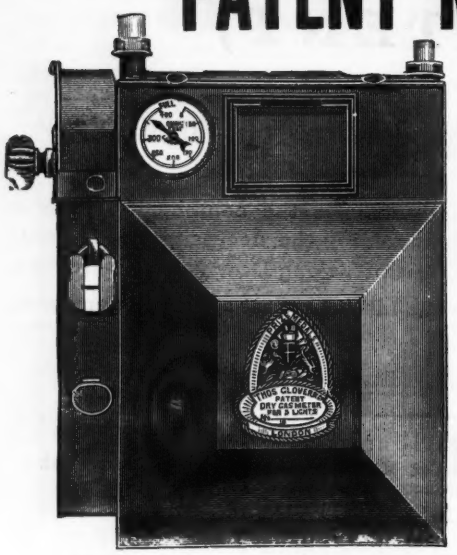

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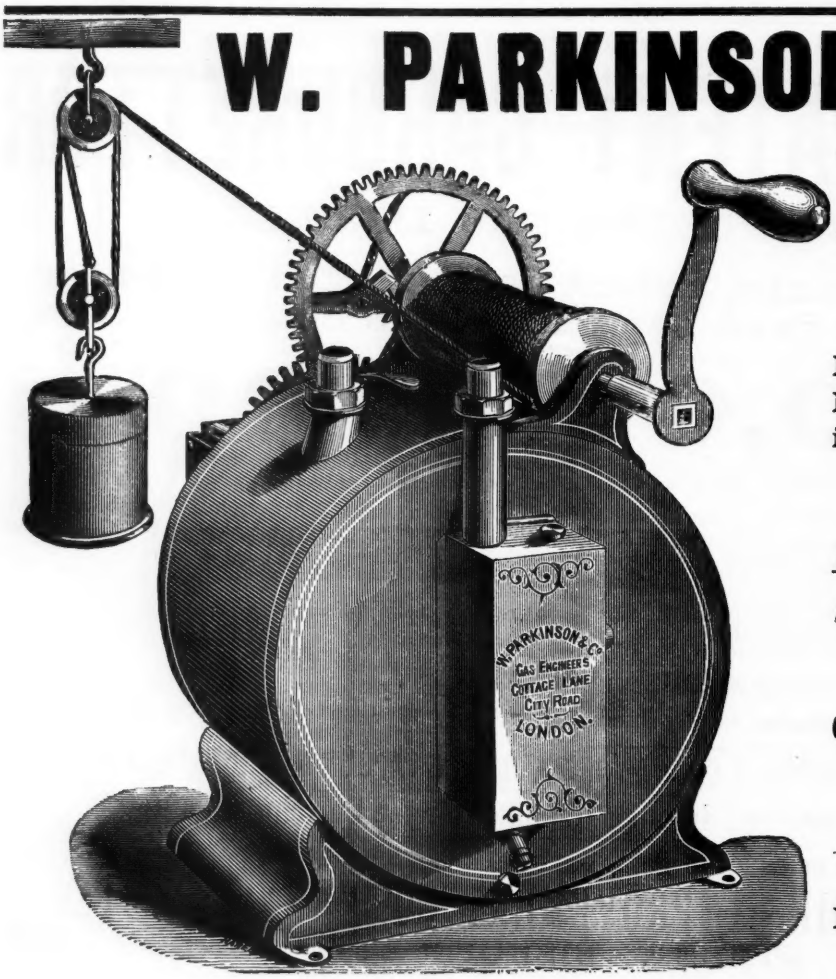

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EDITORIAL NOTES.

A Retrospect of the Year 1895.

ONCE again the course of time brings us to the break of the year, when it is natural to look back over the series of events that will be recorded in history under one date, before contemplating the future and its possibilities with another. The "year that's awa'" might be discussed from the standpoints of an infinite variety of experiences, under as many aspects. It is enough for us here to offer a few reflections upon it from the point of view of the observer of the course of the nation's trade and commerce in general, and of that of the national industry of gas supply in particular. The year has been one of marked improvement of trade everywhere, with the usual concomitants of feverish speculation and interruption by labour troubles. The peace of the world was maintained, with the exception of a little forcible clearing up of the misunderstandings between China and Japan, which had appeared to bar the way of civilization in the Far East; and the extension of commercial enterprise into what were previously waste regions in South Africa and Western Australia, with other more obscure causes, had the effect of considerably swelling the volume of the world's manufacturing output and trade. A very striking feature of the past year was the cheapness of money, leading to the unprecedented appreciation of first-class investments. Money was almost unlendable; while at the same time there was a great deal of gambling in mining and other highly speculative stocks and shares. The state of the investment market was brought under the notice of the authorities of the Royal Courts of Justice by the discovery of the necessity for reconsidering the official rate of interest to be allowed on money under the control of the Courts, which has hitherto been 4 per cent. It had become impossible for trust funds to be put out upon convertible securities yielding much more than 2 per cent. The same story is told by the remarkable rise in the value of gas stocks. At the beginning of the year, Gaslight and Coke "A" stock stood at about 250; it is now worth close upon 300. South Metropolitan "C" stock rose during the year from 300 to 330. Either Company can now borrow money, by selling debenture stock, at very little over 2¾ per cent. It may be, and probably is, true that some of this improvement had its origin in the special advertisement that gas property received during the year, as a result of certain parliamentary proceedings to be discussed farther on; but it must be ascribed mainly to the unprecedentedly high position of all "gilt-edged" investments. Throughout the spring and summer, there was little or nothing doing in financial circles. But after Midsummer, there came a remarkable revival of speculation; and the usual autumn holiday season was consequently abrogated so far as "the City" was concerned.

Several of the new companies launched about this time were in connection with some branch of the gas industry. There were gas-meter and gas-burner companies started with a view to doing business at home and abroad; but not—so changed are the times—a single electrical concern of any sort attempted to compete for the favour of the investing public. Remembering what was done in the palmy days of "Grandfather Brush," this revulsion is indeed noteworthy. Incandescent gas-burners and coin-controlled gas-meters were the favourites of company promoters on the side of gas. Welsbach light finances appeared to reach an unheard-of height of prosperity; and this had the usual result of bringing many rivals into the field. The vicissitudes of some of the joint-stock ventures of the day are worth recording. The past year saw the end of the North British Water Gas and the Wenham Lamp Companies; and a curious speculation, started with a great flourish with the object of turning smoke and factory fumes into gold, likewise came to speedy grief. The arrest of the prime mover in the Liberator frauds, and the proceedings which eventuated in his conviction and punishment, drew attention to the inadequacy of building societies as means for the safe and profitable investment of small savings; and an impetus was thereby imparted to the movement for enabling small capitalists to acquire corporation and gas stocks. On the whole, therefore, the financial history of the year has a considerable degree of interest, even for the observer who

was neither one of the few who made a fortune nor of the larger contingent who lost money.

A discussion was started early in the year by an experienced accountant upon the subject of the indebtedness of local authorities and the policy of debt-reduction which the law imposes upon them. The debate was revived later on in the JOURNAL, with particular application to the comparative circumstances of gas companies, whose capital is irredeemable, and local authorities owning gas undertakings, whose capital has to be wiped out within a stated period. Not very much resulted from this ventilation of the subject, beyond, perhaps, the setting forth of the academic principle that it would be desirable if all gas capital, however held, represented assets. The effect that such a principle would have upon taxation and rating was not considered.

Reductions in the price of gas were recorded during the year in many places. The South Metropolitan Company succeeded, after a troubled interval of six years, in getting back to the lowest price—2s. 3d. per 1000 cubic feet—at which gas has ever been sold in London. The Manchester Corporation distinguished themselves by making a sweeping reduction of 3d. per 1000 cubic feet in the charge for gas over the heads of the majority of their Gas Committee. Meter-rents were abolished by The Gaslight and Coke Company, and also by the Manchester and Leicester Corporation Gas Departments. Almost everywhere the increased price of gas due to dearer coal and labour began to yield to the influence of enlarged consumption and economies in manufacture; so that the selling rates of 1889 were restored, or nearly so. A terribly severe January sent up the demand for gas and coke enormously; and the start thus imparted has been generally maintained so far as gas consumption is concerned. Coke has, however, been saleable only at lower prices. The Metropolitan gas coke market has, indeed, suffered greatly from the depressed condition of the portland cement industry, which used to take upwards of 25 per cent. of the output of the London works, and is reported to be in course of being ruined by the German bounty system.

This topic leads to that of the gas residuals markets. Sulphate of ammonia was never in worse case than at the present time; having fallen in value during the year from £11 to £8 10s. per ton, and consequently being hardly worth making, as a matter of business. Opinions differ as to the cause of the collapse; but, as usually happens, such a downfall is probably due to a combination of circumstances. Certain big producers are suspected of having overreached themselves in the endeavour to force up the price, and being consequently left with stocks that it is equally ruinous to sell or to keep. Then, again, the nitrate "boom" of some years ago has hopelessly given way; and the agricultural interest is too depressed to enable farmers to sink money in chemical manures. From whatever causes arising, the painful fact remains in evidence that the least profitable of gas residuals last year were coke and ammonia. Strangely enough, as the year waxed and waned, a lively demand arose for pitch and benzols, to say nothing of other tar products. Benzols especially, worth at one time about 1s. per gallon, are now nearly touching 2s. 6d.; and dealers continue to make active inquiries after the volatile commodity.

Gas coals dropped in value during the year by about 1s. per ton, which, of course, was one of the sources of weakness in the coke markets, wholesale and retail. Another raw material of gas manufacture which has grown into importance of late—mineral oil—has passed through several somewhat disquieting changes. So far as can be ascertained, it does not appear likely that oil suitable for gas making will advance from the figure at which it is possible for gas manufacturers in the United Kingdom to touch it; but burning oils have shown at least two determined "booms" during the year. The first was based upon the report that the American oil-fields were showing signs of exhaustion; and it lasted until common lamp oil doubled in price, when it came to an end. The second is still with us. These phenomena are ascribable to the remarkable success of the Standard Oil Company of America in getting control over the bulk of the lamp-oil supply of the world, which in some circumstances enables them to make the market price to suit themselves. It is not so much a "ring" as a monopoly, and a stronger one than could be conferred by Royal patent or safeguarded by statute.

With regard to "rings," the year witnessed a notable triumph of Mr. George Livesey over certain tentatives of makers and dealers in gas-works necessaries in this direction. Having reason to suspect these traders of a design to combine with the object of artificially raising the prices of their commodities as against gas undertakings, Mr. Livesey declared in set terms that, unless the idea was abandoned, the South Metropolitan Company would make everything they wanted for themselves. The threat was effectual. While Mr. Livesey's name is before us in this connection, it will be convenient to put upon record another incident of the year which turned upon a manifestation of the same pervasive and powerful personality. It was a scheme of legislation for the South Metropolitan Company, which, though it proved abortive for the occasion, is again to the fore in a slightly modified form.

The South Metropolitan Gas Company promoted a Bill in Parliament last session for the purpose of consolidating and unifying their capital stocks upon a 5 per cent. basis, as had been permitted in other cases. Mr. Livesey wished to include in the Bill a scheme for enabling employees of the Company, interested in it as holders of stock by virtue of the Company's profit-sharing system, to be directly represented upon the Board. The Bill as submitted to Parliament, however, contained no such provision, though the statutory notice of it had been duly published. An irregular disclosure of the nature of the scheme in a London newspaper led to a revelation of Mr. Livesey's wishes at the ordinary general meeting of the Board in February, when the Directors were found to be divided on the subject, with the Chairman in the minority. Later, the unusual course was taken by the then President of the Board of Trade—Mr. Mundella—of moving in the House of Commons an instruction to the Committee on the Company's Bill to consider and insert therein the Livesey provision. But the Bill was withdrawn upon the rejection by the Committee, at the instance of the London County Council, of the capital consolidation clauses. So the workman-director scheme fell through, for all the encouragement it received outside the South Metropolitan Board. But, as already stated, it is going forward again—Mr. Livesey having so far carried his point at the last meeting of the Company; and the Bill is once more upon the stocks, this time with the consolidation of the capital proposed upon a 4 per cent. basis. A sharp controversy upon the subject of the workman-director was carried on through our "Correspondence" columns by the Chairman of the South Metropolitan Company and Colonel Makins, the Governor of The Gaslight and Coke Company, who sought to prove that the idea was impracticable, uncalled for, and pernicious.

The general legislative record of the year is poor, owing to the defeat of the Government in the middle of the session, and the consequent interruption of parliamentary work by a General Election, which changed the Administration. It was impossible for those interested in gas supply and kindred undertakings to regret the change, because the old Government was weak enough to be under the influence of Labour and other agitators, who sought to alter the law of employers' liability for accidents to workmen, the Borough Funds Act, the Valuation of the Metropolis Act, and other statutes for the protection of the interests of Capital from socialistic assaults. The new Administration are pledged by their actions while in opposition to deal with such questions as that of employers' liability with due regard to the preservation of freedom of contract. Among the new statutes that came into effect last year was the Notice of Accidents Act, which originally applied to gas-works in course of construction and in operation. By the Factory and Workshop Act, 1895, however, the former Act was repealed in so far as it applied to gas-works—a striking illustration of the mystifying habit of Parliament that has been denounced under the name of "legislation by reference," by which a clause a few words in length slipped into an Act may change a prior statute bearing a totally different name.

The Private Bill legislation of the year as regards gas supply included several important measures authorizing the transfer of gas undertakings to local authorities. Among these were the Chesterfield Gas and Water Board Act, which directed the undertaking of the Chesterfield Gas and Water Company to be sold to a composite Board, at a price to be ascertained by an open valuation now being arranged for. This Board will be obliged to apply all surplus profits to reducing the price of the supply.

The Ambleside undertaking was also to be transferred by arbitration. The Hebden Bridge and Mytholmroyd Gas-Works were transferred at an agreed value, based upon 27 years' purchase of the maximum dividends. The Brighouse and Clonmel works were also the subject of Transfer Acts. The Accrington undertaking was taken over by a Board; and several other proposals of the same character were set on foot and discussed with a view to future action. A Bill of the Dublin Corporation containing proposals inimical to the Alliance and Dublin Consumers' Gas Company was abandoned in consequence of an adverse poll of the ratepayers.

The Law Courts were occupied with several important suits affecting or in connection with gas supply, though there was no very heavy gas litigation. The Commercial Gas Company raised a question regarding the action of the Chief Gas Examiner for London. Two gas managers were fined for offences under the Alkali, &c., Works Regulation Act. The Hertford Gas Company had a painful experience in regard to the management of their affairs, which subjected them to prosecution under the law relating to the publication and deposit of accounts. The South Metropolitan Company were cast in damages in a small amount in connection with a street explosion. The working of the prepayment meter system gave rise to several Police Court cases of a novel character. The Croydon Gas Company were successful in an important and instructive assessment appeal. The progress of the incandescent gas-burner gave occasion for the commencement of much patent litigation still in course of development. One such case—that of the *Incandescent Gas-Light Company, Limited, v. Cantelo*—was brought to an issue, and served to define the rights of patentees in respect of the conditions imposed upon the sale of patented articles.

The new discoveries and inventions of the year can, as usual, be distinguished with difficulty from the progress made by improvements and processes still novel yet not absolutely new. In gas-works, the great feature of the year was the extension of carburetted water-gas production, and of mechanical and other labour-saving appliances for coal-handling and carbonizing. Carburetted water-gas plants of two leading patterns occupied much attention in gas engineering circles, both for carburetting coal gas and for production in bulk. Sloping retorts, thanks largely to the skill and devotion of the Brentford Company's engineering staff, held their ground and even made some headway; and mechanical stoking for horizontal retorts, after two leading types, grew greatly in favour. Purifying plant and methods showed some tendency to modification in the direction of the abolition of the water-lute and the use of Weldon Mud for "check" boxes. The construction of columnless gasholders proceeded apace. In gas distribution and utilization, the year was memorable for a great expansion of the coin-controlled meter system, and the extraordinary popularity of incandescent burners for both indoor and outdoor lighting. The introduction of carbide of calcium as a source of acetylene upon the commercial scale created a considerable sensation. Much research into the principles of coal-gas enrichment was carried out; and some remarkable results were published by Professor Vivian B. Lewes, Dr. R. Forbes Carpenter, Dr. Dvorkovitz, and others; and an experiment by the last-named expert at Bradford gave rise to an acute controversy. At the same time, the expediency of enriching gas by any process was made the subject of question by advocates of cheap gas; and a good deal of ill-directed agitation on the subject arose in Liverpool. The question of the photometrical standard of light was much to the front during the year; and the Committee appointed four years previously by the Board of Trade to investigate this matter reported in favour of the substitution, for the parliamentary standard candle, of Dibdin's 10-candle pentane lamp standard. The application of coal gas to the working of tramcars was further developed by experiments at Croydon with the Lührig system of propulsion by this agency.

The state of Labour during the year would occupy a long article to even imperfectly put upon record. The "New Unions" of unskilled workers lost ground very seriously, albeit some of them were still strong enough in places to give trouble. But the arrogance of their professional leaders seemed to increase as they felt the ground crumbling away from under their feet, until the shock of the General Election threw down many, and destroyed the factitious prestige of the rest. One or two disastrous lawsuits, moreover, showed Trade Union officials that "the liberty of the subject" is still something more than a phrase in this country. At the Trade Union Conference, held at Cardiff, professional agitators having no real connection with the cause they exploit received signal discomfiture; though subsequent events go to show that the socialistic taint has struck too deeply into the system of Trade Unionism to be extirpated by the removal of those who carried the infection. Insensate strikes broke out among the Leicester boot operatives, and, towards the end of the year, in the engineering branch of the shipbuilding industry of the Clyde and Belfast. The former failed; the latter is still in progress—the mediation of Lord James of Hereford having been ineffectual in restoring peace. In both instances, the outbreak showed the employers have at length learnt the wisdom of combined action against the common foe.

Several more or less disastrous accidents and casualties happened in connection with the manufacture and distribution of illuminating gas. Early in the year, several cases of poisoning by the inhalation of escaped gas occurred in Glasgow; and the year witnessed the appearance of a novel trouble in the shape of gas explosions in electric street culverts, which formed the subject of Government inquiries that led to remarkable disclosures, duly recorded in our columns at the time. A serious explosion traceable to leakage from a broken gas-main in a court off the Strand in October, led to the death of a Metropolitan fireman, and caused great destruction to some old house property, the ultimate responsibility for which is not yet settled. A purifier explosion at the Dalmarnock gas-works, unattended by loss of life, was the occasion of the holding of a Government inquiry under the new law applying to such matters. A slighter one, due to the carelessness of workmen, happened at the Poplar gas-works.

The technical associations last year maintained their usual activity, usefulness, and popularity. The Incorporated Institution of Gas Engineers held a most successful meeting in May, in the new building of the Royal United Service Institution, under the presidency of Mr. C. C. Carpenter; and the autumn meeting of the same Institution, in Liverpool, was the most satisfactory gathering of the kind in the annals of the organization—thanks mainly to the good offices of Mr. William King. The Incorporated Gas Institute meeting was held in Edinburgh, under the presidency of Mr. Robert Mitchell, and was very largely attended. Mr. Joseph Hepworth resigned the position of Honorary Secretary of the Institute, and was succeeded by Mr. A. Dougall, of Tunbridge Wells. The Secretary (Mr. F. G. Burfield) also resigned; but his successor has not yet been appointed. The North British Association and the various District Associations did fairly during the year, with the exception of the South-West of England, which opened negotiations for amalgamating with its near neighbour, the Southern District Association. Some of the chemical and other scientific societies were also made the recipients of good papers on subjects connected with the gas industry.

The year was remarkable for the number of personal changes in the ranks of the gas engineering profession, which are too numerous to be recited here. Among the most important, however, may be chronicled the retirement of Mr. J. Hepworth from Carlisle, to be succeeded by Mr. C. B. Newton, from Rotherham. Mr. T. Whimster relinquished the management of the Perth gas undertaking, and was succeeded by Mr. A. Wilson. Mr. W. Barratt, late of Grantham, was followed by Mr. R. G. Shadbolt; Mr. H. Ashton Hill left Wallasey, and was succeeded by Mr. J. H. Crowther. Mr. H. Townsend left Plymouth, and received the Wakefield appointment. Mr. F. F. Farrand was promoted to succeed his late chief, Mr. George Garnett, at Ryde. Mr. T. Duxbury resigned his position at Darwen, and Mr. A. E. Loam did the same at Stalybridge. There were some important changes in the administration of the Imperial Continental Gas Association. The Right Hon. Sir Julian Goldsmid, Bart., M.P., retired from the chairmanship—Mr. T. H. G. Newton succeeding him; and Mr. R. S. Gardiner resigned the secretaryship, Mr. G. F. Thompson being appointed in his stead.

Many well-known names are included in the death-roll of the year. Mr. Robert Jones, late of the Commercial Gas Company; Mr. Thomas Hardick, late of Salisbury; Mr. Denny Lane, of Cork; Mr. W. Thorman and Mr. John

Thorman, were all names—and several of them something more—familiar and respected in the gas engineering profession. Mr. A. Willey, of Exeter, did not long survive his father, the founder of the firm. Mr. John Clapham, of Keighley; Mr. R. W. Brownhill, the first patentee of coin-controlled gas-meters; Mr. C. H. Parkes, the first Government Auditor of the London Gas Companies' accounts; Mr. George Flintoff, the most notorious gas agitator of any period—all these in their day filled a space in the striving technical and commercial world, and are now at peace.

Little more remains to be said concerning the past year, which appears, from the cursory history we have been able to glance at here, to have been as full of effort and incident as any that have gone before it. The volumes of the JOURNAL which cover it are fuller of matter than most of their precursors in the series, which shows that a great deal has been going on and talked about in connection with the industry to the chronicling of which its space is devoted. This is a good sign. Turn we now to the year that opens for us with our next number, in the confident hope that, in the future, endeavour and realization will not fall below the standard of any past time.

WATER AND SANITARY AFFAIRS.

The Principal Events of the Year 1895.

THE year now expiring opened with the prospect of a heavier onslaught than at any previous time on the part of the London County Council against the Metropolitan Water Companies. The eight "Transfer" Bills for the acquisition of the Companies' undertakings were ready for introduction into Parliament; and it was evident that if these measures received the sanction of the Legislature, very serious loss would accrue to those parties who had invested money in the undertakings thus marked out for spoliation. But there was a crisis coming on which affected the position of the County Council. In the month of March, the Council would have to undergo the ordeal of a fresh election; and this circumstance had the effect of eliciting a distinct declaration of policy from each of the two parties who sought to have the predominance at Spring Gardens. The Progressives were all in favour of the Transfer Bills, and contended that the water supply belonged solely to the County Council. On the Moderate side, there was a tendency to favour the idea of control rather than acquisition; and there was a recognition of the importance attaching to the outer areas. What may be termed the official manifesto of the Moderate party demanded that, in proceeding to acquire the property of the Water Companies, there should be clear evidence that the ratepayers would not be made to suffer. Failing such evidence, the Moderates proposed that steps should be taken for promoting a Bill to constitute a Statutory Committee, which should represent not only the Administrative County, but the whole of the outside districts concerned; this Committee to exercise "control" over the Companies, so as to secure alike to the consumers and the ratepayers "every possible advantage and convenience."

In the light of more recent events, it is interesting to look back and review the ideas thus expressed at the beginning of 1895. What the ratepayers thought of the matter may be judged by the result of the March elections, by which the large Progressive majority on the Council was made to disappear, and the scale was turned in favour of the Moderate party. It was only by the aldermanic machinery that the Progressives were able to maintain their footing in the Council. The vote of the municipal electorate was clearly against them. London was not led astray by the brilliant promise of what should accrue if the property of the Water Companies was "transferred" to the Council. Still, there was the parliamentary campaign to be passed through; and there was just the chance that Progressive tactics would be successful in a quarter where so many sympathizers were to be found. The Council had even looked beyond the session of 1895, if not to something still more remote; for just before the election of the new body, the old Council—the second in order of time—adopted a series of recommendations from their Water Committee, in contravention of the report of the Royal Commission presided over by Lord Balfour of Burleigh. These recommendations proposed that, instead of agreeing to the construction of large storage reservoirs in the Thames Valley, the Council should authorize the preparation of a scheme for the introduction of an entirely new supply from a different source, with the view of an application to Parliament for the necessary powers to carry it out. This proposal forms part of the work on which the Council have continued to be engaged. It was still in the days of the second Council, and immediately after passing the recommendations of the Water Committee for seeking a fresh source of supply, that two of the Transfer Bills passed their second reading in the House of Commons—one of them having reference to the Lambeth Company, and the other to the Southwark and Vauxhall Company. The fervour with which Mr. J. Stuart and others who acted in the interest of the County Council pressed forward the second reading of these Bills, seemed to suggest some fear lest the elections then close at hand should change alike the constitution and the policy of the Council. By a resolution of the House of Commons passed only two days before the County Council elections, the second reading of the six remaining Transfer Bills was postponed until the 3rd of May.

A phenomenal frost which prevailed during the month of February, and nearly up to the middle of March, was the cause of much embarrassment to the Water Companies, not only in London, but in other parts of the kingdom. Water remained frozen in all the communication pipes for several weeks; and the flow in the mains being thus impeded, the water in some of those which were not at the lowest depth became also congealed. The London Companies did their utmost to mitigate the consequences. After they had done all that lay in their power, and expended many thousands of pounds in the effort, a Government inquiry was instituted, presided over by General Scott, who held several sittings in different localities, and took a large amount of evidence. This unfortunate affair was turned to account by the ever-ready critics of the London Companies; and it was made to appear as if the freezing up of the supply was due in some way to the fact that the undertakings were not possessed by the County Council. But it was pointed out that towns where the water supply was the property of the local authorities fared no better than London, and in some cases even worse.

In the month of April, a debate extending over a period of three hours was brought on in the County Council by Mr. Benn, who moved that it was desirable to press forward the Bills for the purchase of the Lambeth and the Southwark and Vauxhall Water Companies "with all "possible speed." Sir J. Lubbock moved an amendment requesting information as to the financial aspects of the proposed purchase. The amendment was rejected, and the motion was carried by a large majority. On April 29, an unreasonable arrangement was effected in the House of Commons, as moved by Mr. J. Stuart and supported by the (then) Government, whereby the Bill of the Chelsea Company, asking for power to raise £50,000 of additional capital to enable them to lay down a new main, was referred to the same Committee as the Transfer Bills relating to the Lambeth and the Southwark and Vauxhall Companies. A Bill promoted by the Lambeth Company was referred in like manner. A policy of adjournment was applied to the four outstanding Transfer Bills; the order for their second reading being postponed on May 6 to June 13.

On May 14, the Hybrid Committee, presided over by the Right Hon. D. Plunket, commenced their inquiry into the two Transfer Bills which had passed their second reading, and the Bills of the Chelsea and Lambeth Water Companies. The first Bill to be dealt with was that for the transfer of the Lambeth undertaking. At the close of the day's sitting, the Chairman stated, for the guidance of Counsel, that the Committee intended to follow the line laid down in the report of Sir Matthew White Ridley's Committee in 1891—that it was desirable to establish a single public representative Water Authority for the whole of the Metropolis. This announcement was referred to by Mr. Balfour Browne, Q.C., on the opening of the second day, as if it pointed to the London County Council. But Mr. Plunket gave a kind of hint that Mr. Browne was travelling a little too fast. The words in the report of the Committee alluded to were to be taken for what they were worth, and no further construction was to be put

upon them. At a subsequent sitting, Mr. Pember, Q.C., who appeared for four of the Water Companies, proposed to deal with the question as to whether the County Council would be "the best body" to have charge of the Metropolitan Water Supply. But the Chairman considered that this was out of course, seeing that in no one of the many petitions against the Transfer Bills was there any alternative suggested as to the creation of another authority. There was, in fact, no counter-scheme; and the Committee must take the Bill simply as they found it. Another conclusion showed that if there was to be one central authority, the principle of purchase at once ensued. The extraordinary arbitration clause in the Bill was not rendered more pleasant or equitable in appearance when viewed in the light of the evidence given by Mr. Cripps, the Parliamentary Agent of the County Council. Neither was there any improvement in the nature of the conditions by which the undertakings were to be transferred before the price to be paid for them was settled. A critical stage was reached on the thirteenth day of the sittings; the Committee then deciding that the Arbitrator, instead of being restricted to such considerations as detracted from the value of the Company's property, should be at liberty to take evidence on all the points concerning which he thought proper to receive information. Upon this the County Council proceeded to draft an alternative clause, which was submitted to the Committee on June 25. At that sitting, the Chairman said the Committee were disposed to put a clause in the Bill which would debar the Council from purchasing one or more of the undertakings without acquiring the whole. It was also stated to be the intention of the Committee to give the Arbitrator an optional power to award a sum in respect of compulsory sale. But a crisis of an Imperial character was now overshadowing the scene; and at its twenty-first sitting, the Committee declared its own dissolution, just five days before the dissolution of Parliament.

There was thus the appearance of a large sacrifice of time, trouble, and money. Yet it was rightly declared in *The Times* City Article that the labours of the Committee, and of others engaged in the inquiry, had "not been thrown "away." Facts had been brought to light, and principles had been established, which could not fail to influence the future deliberations of Parliament. A fresh test of public opinion was now brought to bear in respect to the question of the Metropolitan Water Supply. Candidates for the suffrages of a London constituency based their claims partly on the course they were prepared to take with regard to this particular subject. But the London electors failed to show their gratitude to the Progressive candidates; the latter being, as a rule, rather unlucky. The *Daily Chronicle* was sorely disappointed, and wondered what had happened to the London working man. The plunder of the Water Companies proved to be less popular than was expected. But the skies gave some help to the adversaries of the Water Companies. Phenomenal frost was followed by equally phenomenal heat, aggravated by a prolonged deficiency in the rainfall. In July, the supply of water to the East London district was greatly reduced. Parliament, in the session of 1893, influenced by the County Council, who were aided by the Government, had refused permission to the East London Company to enlarge their capital so as to provide funds for an extension of their works, then declared to be necessary in order to secure an adequate supply. The urgency of the case and its direful character were at length unmistakeably displayed. The distress among the East-enders was all the greater, owing to the general abolition of house cisterns. Of course, every attempt was made to bring the East London Company into disrepute, although the Company were rendered simply helpless by circumstances over which they had no control. Their Bill had been passed in 1894; and not a day was lost in commencing the execution of the necessary works. But a year had gone by; and the works which could have prevented the calamity that befell the people were just so much too late for that purpose. A striking circumstance occurred in connection with this affair—the new President of the Local Government Board, Mr. Chaplin, paying a personal visit to the East-end, to satisfy himself as to the degree of inconvenience the people were suffering, and as to the character of the works which were then in hand. Mr. Chaplin seems to have been impressed with the *bona fides* of the Company; and he succeeded in getting himself virulently abused by the *Daily Chronicle* for his impartial scrutiny of the facts. A fussy agitation got up by one or two vestrymen at length took the shape of a formal demand for a Government investigation into the failure of the supply. This was granted; and it was carried out by Colonel Ducat, R.E., and Dr. F. W. Barry, Inspectors under the Local Government Board; the County Council taking a prominent part in providing evidence. The Inspectors paid a visit to the works in progress; and they appear to have been gratified with what they saw. The extent of the works, the excellence of the design, and the admirable manner in which the plan is being carried out, found recognition in an able article which proceeded from the pen of a representative of the *Daily News*. In addition to this inquiry and that with reference to the frozen mains, there has been a third, also conducted by the Local Government Board, relative to the capacity of flushing-cisterns used in water-closets. This resulted from an application on the part of the County Council; and it has cost that body close upon £900, in place of the £250 which they estimated.

At the close of July, the County Council issued the report of their Engineer—Mr. A. R. Binnie—giving an outline of their great scheme for bringing a supply of water to London from the head waters of three rivers in Wales. When the scheme was in full operation, the estimated supply would be at the rate of 415 million gallons per day; the capital outlay being £38,800,000. To convey a supply of 200 million gallons per day would cost £18,095,000. But surveys and investigations, in order to bring the scheme into parliamentary shape, are still going on; and it appears they will continue until next Christmas.

The County Council, having their Transfer Bills in a state of suspension, and having to face a greatly altered House of Commons, proceeded to consider, in the middle of October, what they had better do. Their Parliamentary Committee recommended that, as it was desirable for the supply of water in and around the Metropolis to be in the hands of a public authority, the Government should be invited either to deal with the question themselves or to appoint a Royal Commission to do so. To this Mr. Stuart moved an amendment, that the Transfer Bills should be proceeded with next session. On a division, this was negatived by the bare majority of one. The debate stood over for a week, when Dr. Collins succeeded in carrying a resolution requiring the Parliamentary Committee to report the lines on which, in their opinion, the Government should be asked to legislate. Three weeks ago, the Committee presented their report; and after the lapse of a week it underwent discussion. The main proposal was that the Government should be asked to constitute by Act of Parliament a Water Authority for London and the surrounding districts. This recommendation, as might have been expected, was set aside, and preference was given to an amendment, moved by Mr. Kinnon Wood, proposing that the Government should be asked whether they would promote or assist legislation dealing with the Metropolitan Water Supply in such a way as to give the entire control of the supply within the area of the Administrative County into the hands of the County Council in conjunction with the City Corporation, leaving the supply of the outer areas to the control of the Local Authorities in those districts. This amendment was carried. A further resolution authorized the Water Committee to open negotiations with the Water Companies for the purchase of their undertakings. The probability of success in approaching either the Government or the Companies appears abundantly doubtful.

The County Council make very small promise of an appearance in Parliament in 1896. The field is left open to the Water Companies, except that the Council will oppose whatever the Companies may bring forward. The Council have a little Bill of their own, by which they seek to make it compulsory on the East London Company to give their constant supply at a greater pressure than heretofore. The Staines reservoirs scheme, promoted by the Grand Junction, West Middlesex, and New River Companies, is a large and well-conceived project. The works of extension and improvement provided for in the Bill of the New River Company are of great magnitude. The Southwark and Vauxhall Company have a Bill to authorize large additions to their works. The Bill for the formation of a Kent Water Board is an entirely new device; but its progress appears doubtful. At the half-yearly meeting of the Chelsea Water Company a few days back, a hope was expressed that the Directors would not withdraw the

Bill which stood suspended from the date of the recent dissolution of Parliament.

The history of the water supply in the provinces during the past year does not present any features of a remarkable character. Mention has been made of the fact that in several cases considerable inconvenience was caused by the prolonged drought. The Barnsley Corporation Water Bill passed the House of Lords; but it remains suspended—awaiting its second reading in the House of Commons. It was strenuously opposed by parties interested in the watershed of the Little Don, and especially so by the Sheffield Corporation. More or less of the supply to be obtained from the Little Don or Porter River and its tributaries is claimed by several Local Authorities, and is a special bone of contention among them. An account of various Water Bills for the coming session appeared in our columns early in the month; one promoted by the Sheffield Corporation being of considerable importance, especially in its bearing on the Little Don question. The struggle for water areas throughout the country is becoming increasingly earnest; and the authorities of the area affected by the Welsh scheme of the London County Council are anxiously on the alert.

Personal.—A capital portrait of Mr. William Statter, J.P., has just been hung in the Directors' room at the Wakefield Gas Company's offices. Mr. Statter, who is in his 90th year, has been Chairman of the Company for more than fifty years. The portrait has been painted by Mr. T. Mostyn, R.B.A.; and the cost (£200) was voted by the shareholders at their last half-yearly meeting.——A vote of condolence with the family of the late Mr. T. S. Weeks, Assoc.M.Inst.C.E., whose death was recorded in the JOURNAL last week, was passed at a special meeting of the Torquay Town Council last Thursday. The resolution referred to the effective and efficient manner in which Mr. Weeks performed the duties of Water-Works Engineer of the borough for upwards of 31 years. The Mayor (Alderman E. P. Bovey), by whom it was moved, stated that during that time Mr. Weeks enjoyed the confidence and respect of the town and of the Council. When Mr. Weeks was appointed in 1864, the gross receipts for water-rentals amounted to £3000 per annum, and they were now £13,000. Throughout the period of his official connection with the works, the Water Committee were very much indebted to his valuable counsel and the thorough grasp he had of the concern. Mr. Appleton, the Chairman of the Water Committee, in seconding the motion, said that the late Mr. Weeks was a most conscientious, accurate, and painstaking official.

The Town Clerkship of Croydon.—Mr. E. Mawdesley, the Town Clerk of Dewsbury and the Clerk of the Dewsbury and Heckmondwike Water-Works Board, was last week appointed to the town clerkship of Croydon, rendered vacant by the recent death of Mr. C. M. Elborough. During the last eleven years, Mr. Mawdesley has had large experience in municipal work. In 1884, he was elected Town Clerk of Swansea; and in the six years he was there, he had the management of the whole of the legal work of the office. One of the cases which he conducted was an important water-works action—*Lewis and Sons v. Swansea*—which was twice before the Court of Appeal. He also had the experience of promoting and carrying through the Swansea Corporation Water Act, 1884, and also the obtaining of the Electric Lighting Order for the borough. At the latter part of 1889, he was chosen to fill the town clerkship of Dewsbury; and he has since had considerable parliamentary experience in connection with that borough. He was concerned in obtaining the last Act of the Dewsbury and Heckmondwike Water Board and the Dewsbury Electric Lighting Order; and he is now engaged in promoting a Bill for the extension of the water-works.

Presentation to Mr. T. Banbury Ball.—On Saturday, the 21st inst., the employees at the Rochdale Gas-Works celebrated the Jubilee of the gas undertaking and the completion of the extensions, by a dinner and social evening, for which they were indebted to the Gas Committee and the Contractors for the various new erections. The chair was taken by Mr. T. Banbury Ball, the Engineer and Manager, who was supported by Mr. T. Stenhouse, the Borough Analyst. Mr. Ball made some interesting remarks, and compared the present conditions of labour and remuneration in the Gas Department with those of forty or fifty years ago. During the evening Mr. Stenhouse spoke of the esteem in which Mr. Ball was held, and concluded by asking Mr. T. Mills to make a presentation on behalf of the workmen, every one of whom had, he said, subscribed towards it. This consisted of an elegant timepiece with the following inscription: "Presented to T. Banbury Ball, Esq., Gas Engineer, by the employees at the Corporation Gas-Works, as a token of respect and esteem, and to commemorate the Jubilee of the acquisition of the gas-works by the Corporation." Mr. Ball was quite taken by surprise, not having heard anything about the matter. During the evening, votes of thanks were passed to the Gas Committee and to the Contractors.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1361.)

CHRISTMAS week came in somewhat opportunely this year. As a general rule, it is only an unwelcome interruption to business, especially when business is good. But it was perhaps just as well that an enforced period of inactivity should succeed the exciting and perturbed week which preceded it. A time of quiet was thus afforded for temperate reflection; and the fever-heat engendered by the President's action had a chance of cooling down. Thus matters rapidly began to improve here at home; although progress was at first somewhat hampered by heavy selling in Paris. Gradually, however, the tendency to improve spread in wider circles; and a smart recovery all along the line was effected before the close. Prices in every department had a nice rise, especially in the American and Foreign markets, which, as the largest losers, had the greatest scope for recovery. The general amenity was favoured by the prospect of an easy settlement to wind up the old year satisfactorily, and give it a "happy despatch." The Money Market fairly maintained its improvement; the demands of the season being good. The Gas Market was extremely quiet; business being unusually slack on all four days of the week. Changes in quotation are naturally very few in number; but they serve to indicate the main lines on which the general movements run just now. These are the strong and increasing demand for the stocks of the Metropolitan Companies and other home undertakings, contrasted with the falling tendency exhibited by the Continental Companies. Thus, South Metropolitan advances, while Imperial and Union recede. In Gaslights, business was as quiet as it well could be. About half-a-dozen deals in the "A" were the total; nothing at all being marked in any of the debenture, preference, or limited issues. About as much was done in South Metropolitans; and the "A" stock more than once realized the record price of 381. Nothing at all was done in Commercials in the market; but we heard of a large parcel of stock having changed hands privately at a high figure. Only one or two transactions were recorded in the Suburban and Provincial division; but the prices obtained show that the great favour with which these investments are regarded by the public, is increasing rather than abating. The Continental undertakings show the "reverse of the medal"—Union and Imperial being weaker. None of the rest exhibit any salient feature. Business in Water stocks was very fair on the first two days of the week, but did not revive after the intervention of the holidays. Prices showed a fair disposition to rise wherever transactions were effected; and Grand Junction made an actual advance.

The days of the working week were so few, and the actual operations so inconsiderable, that it will be sufficient to record that on Monday South Metropolitan "A" rose 2, but Continental Union fell 5, and Imperial 1½; and that on Tuesday Grand Junction Water rose 2½.

ELECTRIC LIGHTING IN 1895.

THE history of the electric light industry in the United Kingdom for 1895 is mainly a chronicle of municipal "enterprise." Joint-stock speculation in the same line is dead and buried; the established electric lighting companies in London and the provinces having been left by investors to struggle as best they can with their troublesome "load factor." Nor has there arisen any new industrial development to help them over this difficulty. Very little has been heard of late of electric motors on central station circuits, or the fantasy of electric cooking appliances, both of which developments were at one time ardently recommended to the favour of the public. The latter were a leading specialty of the firm of Messrs. Crompton and Co., Limited; but the factory of the Company at Chelmsford was burnt down in the autumn, and since then nothing has been done towards helping the electric oven to displace the gas cooker. The destruction by fire of one of the principal central stations of the Metropolitan Electric Supply Company did not tend to reassure the public mind with regard to the harmlessness of this "safe" illuminant. Still, the stocks and shares of the principal London and provincial electricity supply companies fairly maintained, if few of them improved, their position in the market. On the other hand, the obligations of electrical engineering and industrial concerns fell heavily, and some of them were compelled to close their doors; while the most fortunate hardly paid dividends of more than microscopic proportions. It was admittedly a very bad year for all over-capitalized ventures of this order. The only electric machinery and plant contracts going were those of local authorities spurred to adventure into central station electric lighting by the desire to be "progressive" at all hazards; and these were keenly competed for at unremunerative estimates.

Some electric lighting stations which are to be regarded as calculated to satisfy a legitimate demand, such as that installed by the Leicester Corporation, were opened during the year;

and several municipal electric lighting undertakings previously started were reported as doing well and requiring extension. The Liverpool Electric Supply Company's undertaking was agreed to be taken over at a handsome premium by the Corporation. A considerable number of local authorities having electric lighting departments discovered, however, that the rosy promises of those professional and other advisers who had persuaded them into spending the ratepayers' money upon this object were illusory, and were driven to have recourse to the unpopular expedient of levying a rate-in-aid. Some local authorities are yet struggling to solve the problem, not of electricity supply, but of whether electric lighting is really wanted in their districts.

A little fillip of interest was imparted to the vexed question of how to make municipal electric lighting experiments certainly remunerative, by the introduction of refuse destructors and thermal storage as elements in this problem. Shoreditch, St. Pancras, and Cardiff were so far won over to this idea as to adopt combination schemes in which the steam required by electric light generating plant is to be a bye-product of house refuse incineration; but no results were obtained for publication. Some consulting electricians appear to be staking their reputation upon the successful working of combinations of this character; while other electrical experts decline to have anything to do with these experiments.

Another matter that attracted attention during the year—also connected with the problem of improving the profit-earning capacity of central station electric lighting installations—was the expediency of increasing the pressure upon incandescent lamp circuits from 100 or 110 volts to 200 volts. Lamps to carry the increased voltage were made, generally with two filaments instead of one. But though a Committee of Experts appointed by the Board of Trade to consider the question of increasing the voltage of low-pressure circuits reported favourably to the idea, doubts were entertained and expressed as to how the interior wiring of houses fitted for electric lighting could bear the additional strain. The movement for doubling the voltage was initiated by Mr. Sydney Baynes, at Bradford; and it is being prosecuted by him in connection with the extension of the St. Pancras Vestry's electricity supply undertaking.

Much uneasiness was caused during the early part of the year by the frequency of explosions in street distributing conduits and junction-boxes; several occurrences of the kind being on a somewhat formidable scale, and being even more distinctly alarming in character. Endeavours were made by the electric lighting interest to throw the blame for these explosions upon the gas companies. But the discovery of impure metallic sodium in some electric conduits, and the occurrence of explosions in others to which it could not be proved that coal gas had access, led the Board of Trade to issue stringent regulations for putting these novelties of the highway into proper order; and, in point of fact, no explosions of any moment have occurred lately in the electric conduits and street-boxes. This goes to show that these things can be kept in order if a due sense of responsibility for this condition is brought home in the proper quarter.

An ingenious device for encouraging the use of electric lamps over long periods, so as to ameliorate the condition of electricity supply undertakings in respect to the "load factor," known as the "Brighton system," was rather widely adopted last year. By this arrangement, the full price of the unit is only charged the first two hours or so of daily use of the lamps of any consumer; current supplied for the remaining hours of the evening being charged at a considerable reduction. The idea of the system—a very good one—is to make those consumers pay most who only come on the station at the busiest period of the twenty-four hours, and to encourage those customers who are willing to use their lamps all day or night long, if this can be done at the price.

Beyond these few points, there is really little to record as distinguishing electric lighting practice for the past year. Electric traction made some headway, notably in the case of a tram line at Bristol. It was understood, moreover, that capital was obtained for the proposed Central London Electric Subway; and the subway from Waterloo to the City was actively pushed on. But as against this must be put the tacit abandonment of all attempts to make accumulator batteries useful for traction purposes, whether on rail or road, after the waste of infinite effort and enormous sums in the endeavour.

Presentation to Mr. W. Ruxton.—Last Friday, Mr. W. Ruxton, the Assistant Gas Manager at the Arbroath Corporation Gas-Works, was presented by the employees with a marble time-piece, as a testimony of their regard for him on the occasion of his leaving the town to take over the managership of the Berwick and Tweedmouth Gas Company. Mr. R. S. Carlow, the Manager, made the presentation. He said he could testify to the fact that during the time that Mr. Ruxton had been in the works, he had performed his duties faithfully and well. He had now been fortunate in securing the appointment of Manager at Berwick. This was his first step in the ladder as a manager; but he (Mr. Carlow) hoped before many years to hear of his promotion to a larger and more important position. He wished Mr. Ruxton every prosperity in his new sphere. Mr. Ruxton suitably acknowledged the presentation.

COAL CARBONIZING IN BULK AT LANCHESTER.

Among the different systems of coal carbonization that have been suggested and carried into practice of late years, with the chief objects of economizing labour and improving results, there is one which has not hitherto been adopted for works devoted to the manufacture of illuminating gas, but has been brought to a considerable degree of perfection in the cognate industry of coke production. This is the system of carbonizing coal in large bulk, with recovery and utilization of all products and with full application of machinery and labour-saving devices to all the manufacturing processes. In the belief that an account, written from the gas engineer's point of view, of a good modern example of a coal carbonizing works would prove interesting, and to some extent instructive, in the estimation of followers of the coal gas industry, we recently availed ourselves of the kindness of Colonel S. A. Sadler, who opened for our inspection the works at the Malton Colliery, near Durham, for obtaining the facts of the working of this establishment which it is now our intention to recount for the benefit of our readers.* It must be premised that, although our visit to Lanchester was made by Colonel Sadler's invitation, and we were received and shown over the works by Mr. C. J. Sadler and Mr. W. Schroller, of the Durham Coke and Bye-Products Company, Limited, we alone are responsible for the matter of this article, from which, for business reasons, all data of purely commercial value have been omitted. The interest of the Lanchester works for gas engineers, is wholly confined to the bearing of the processes there carried on upon the problem of carbonization.

This problem is attacked at Lanchester, first from the side of metallurgical coke production, and, secondly, with regard to the liquid bye-products. The coal gas, after treatment for the recovery of whatever is worth extracting from it for the products market, has no further value except as a fuel to be consumed on the spot. It is unnecessary to go into detail in respect of the modern development of the metallurgical coke industry of which the Lanchester establishment is an example. The waste attending the operation of coking coal in the bee-hive oven has induced many inventors to try their hands at its prevention without prejudice to the chief product. But it must be confessed that success in this laudable effort has been difficult of attainment. The first question to be asked in connection with an industrial problem of this character, is what meaning ought properly to be assigned to the term, waste? The attainment of the highest possible standard of quality in the chief product is the first consideration. If the best possible quality of metallurgical coke is wanted, then any inferior quality of the article is so much waste of the raw material, labour, and capital employed in its production. It would be foreign to the question in such a case to argue that the operation as a whole is successful by reason of its effecting something else besides the production of coke. It is just the same in some gas-works, where the desired quality of illuminating gas is only procurable by employing materials and processes which, from another point of view, than that of the special gas makers, might be regarded as extravagant and wasteful.

The coke-oven has maintained its credit as the producer of the very highest class of metallurgical coke that money can buy. This class of fuel is required for the working of the very best type of blast-furnaces that skill can design and capital erect, for the production of one of the staples of British industry—the highest grades of finished iron. Buyers of metallurgical coke have consequently framed their judgment of the commodity with regard to its possession of certain characters, which they have learnt to associate with supreme quality; and no consideration of price will induce them to depart from these views. On the other hand, it is not to be supposed that coke buyers entertain an insuperable objection to modify their ideas respecting the characteristics which this kind of fuel may exhibit, provided always that the intrinsic value of the article remains unaffected. This is the position which those who have tried to improve upon the bee-hive coke-oven have had to face. If they could not also improve the coke, they had at least to keep it up to the standard of the best in every respect, or rest content with such diminished value as their chief product would command in the market—the depreciation, if any, going to discount the value of any economies they could effect. Thus, at any rate in the North of England, where the best bee-hive coke has ruled the trade, would-be improvers of the coking process have had little prospect of reward for their ingenuity.

It was not so on the Continent of Europe; and accordingly it is in connection with the coking of the inferior Continental coals that inventive effort has met with the greatest encouragement. Hard coke is hard coke, to the Belgian or German ironmaster, who once satisfied on the scores of calorific value and physical character, has not looked for those refinements of colour and form which the Durham coke buyer has learnt to insist upon as the inseparable concomitants of first-class coke. In these circumstances, it is no small triumph for the Simon-Carvès system of coke production that it has established itself in Durham, where batteries of these retorts now exist alongside the old bee-hive ovens, and that the coke made by the new method finds a ready sale on its merits. Of course, as yet it suffers somewhat

* A view of the works in question is given on p. 1348.

from being outside the "fancy." The bee-hive oven is hotter, by reason of its principle of internal self-generated firing than any externally-heated retort. The charge in the oven is very large, and compresses itself by its own weight; and the quenching of the coke inside the oven preserves a silvery lustre which quenching in the open air (which is apt to be excessive) does not confer upon the product. The yield of coke from the Simon-Carvès retort is so much greater, however, from the same coal —76 per cent. and upwards, as compared with 65 per cent. or thereabouts with the bee-hive oven—that on this account alone the new system possesses solid recommendations worthy of being set against the fancy for appearances.

Leaving the delicate subject of comparison with the bee-hive oven, let us ascertain what the Simon-Carvès retorts are like, and how they are worked at Lanchester. The colliery itself is a mere appanage of the coking plant; for no coal whatever is raised for sale as such. Everything goes into the retorts, and only coke and liquid products are sent away by the railway which bounds the site of the works upon two sides—each siding being appropriated for one of these divisions of the output of the establishment. The coal is a friable, clean-looking mineral, only needing to be put through the breaking machine to fit it for coking, to which it is by nature well adapted. And here we may pause to observe that the quality of coking is something of which nobody has yet succeeded in discovering the cause. Some coals will coke, while others of precisely similar approximate composition (as determined by analysis) will not. An experienced hand will generally tell at a glance whether or not a sample of coal will coke satisfactorily; but the quality, in itself, is something which has hitherto eluded analysis. Dirt is, at any rate, inimical to coking. When broken rather small, the coal is elevated to a hopper capable of containing about 400 tons, whence it fills the charging trucks by gravitation.

The carbonizing plant consists of two ranges, or stacks, each of thirty-five retorts built of fire-brick in the form of a long, high, narrow chamber. These are placed side by side; so that the stack of thirty-five forms a substantial-looking block. It exhibits the unusual spectacle of a retort-bench without a retort-house; for the whole structure is in the open, without any attempt at shelter. The retorts are heated by the gas of their own making; and one-third of the quantity actually burnt (to get rid of it) would suffice for all the purposes of the works. All the boilers are, of course, fired by the waste heat of the retort-stacks, which keeps the steam blowing away. The reflection is forced upon a visitor to these works, that here is an example of a kind of waste of energy comparable to that of the waterfalls which electricians are so partial to "harnessing." We have few unappropriated water power privileges in this country; but millions of British thermal units of heat are every day dissipated into the clouded atmosphere of our mining districts.

Upon the flat top of the retort-benches run the charging tram lines, traversed by conical trucks carrying a load of about 18 cwt. of coal. These stand right over the charging-doors, which open into the top of the retorts, one on each side of the middle line. As the waggon-loads of small coal pour into the retort, young men or lads with rakes passed through holes in the side doors help the charge to level itself in the retort. An ascension-pipe to each retort, not rising far above the top of the bench—empties itself into the hydraulic mains. These are open at one side, like a fishing-box, in order that any accumulation of thick tar in the bottom may be easily got at. The dip-pipes have also a disc-valve to close them when the retort is opened. All the retort-fittings would appear, to the gas maker accustomed to work under cover, of the roughest and rudest description. But this is only on the surface; for the plant works regularly and well, notwithstanding the exposure to the weather, clouds of coal dust, and liability to rough handling.

The most striking aspect of this plant is the "draw." Every retort contains a charge of 5½ tons of coal, which burns off in 48 hours. At the proper time—which the workmen are always ready to anticipate, for their own sakes—the retort is thrown out of connection with the gas-mains; and the doors which form its two ends are opened. A travelling ram, driven directly by means of a rack and pinion from a 12-horse power steam-engine, enters at one end of the retort, and slowly but irresistibly pushes the vertical slice of red-hot coke out at the other doorway. On the discharging side, the ground is prepared for the coke by being paved with brick, and laid as a quenching platform with a slight incline towards the railway dock, where the coke waggons await their turn for loading. At intervals along the outer edge of this platform are standpipes to which the hose for quenching the coke can be attached as required. It is an impressive spectacle to witness the huge slice of glowing coke growing, as it were, out of the opened retort, without visible inducement to move. There is usually no smoke (the charge being too thoroughly burnt off for this), and it is all one colour and texture—top, bottom, and sides. Before the coke moves from the retort, it is seen to have shrunk away from the sides; and it is also diminished in height from that attained by the charge of coal. By the time the charge is about one-third of its length outside the retort, it betrays a tendency to split open vertically. It quickly exhibits its dual formation, with a fissure running through the midst from top to bottom; and then the moving pile splits asunder or topples over on one side. The remainder of the charge, under compulsion of the ram, then pushes the heaped lumps forward; while a couple of strong streams of water quickly change the hue of the mass, and envelop the last of the movement in an impenetrable cloud of steam. This, it strikes the observer, is something like carbonizing by machinery. The machine has something worth doing, in driving out the whole residual coke of a 5½-ton charge. It is not like the petty work of the gas retort-house, where machines are perforce cut down to the measure of the power of a single man, who is as competent, weight for weight, to draw a retort as any mechanism that can be adapted to the purpose. The Simon-Carvès ram discharger does not emulate the man; it simply transcends him, for this particular work.

After the gas and liquid products leave the retort-stacks, they undergo treatment not remarkably different from the ordinary gas-works processes; but with the addition that the gas is also washed with creosote oils for the extraction of its benzene, and with dilute sulphuric acid to make sure of getting all the ammonia. The ammoniacal liquor is treated for sulphate-making in a Simon plant, which is now to be duplicated. The simplicity, the directness, the absence of the superfluous of every kind from the whole apparatus, are most instructive. Where machinery is required, as for exhausting and pumping, it is of the best (Donkin's exhausters), and the excellent tar and liquor pumps made by Messrs. Audemar Guyon, of Dôle (Jura), testify to the care with which the Lanchester management equips the plant. But there is nothing spent upon show, and not much for shelter. It would do many a gas engineering student, trained in the monumental school of gas-works design, a world of good to spend a few months at Lanchester, close to realities of things as these are perceived by men of business who have no Act of Parliament to help them make dividends.

To return, by way of epilogue, to the coking. Is there no lesson here for gas engineers? We are unable to give particulars of the gas made at Lanchester, for the simple reason that none is registered there. Neither the yield of gas per ton, nor the illuminating power is known or regarded. There is neither station-meter nor holder upon the works; but all needful carbonization data could doubtless be obtained by a competent examiner who should obtain permission to spend a few days here. It would be useful to know what are the actual comparative results of carbonizing coal in bulk and in small charges. The investigation may be commended to the attention of those whom its lessons may concern.

A New Carburettor.—The Berlin Anhalt Machinery Company have patented in Germany an apparatus for enriching gas. It consists of a chamber containing a number of slightly inclined corrugated sheets, down which the enriching liquid trickles; the partitions being warmed by hot water or steam pipes placed beneath them. The gas enters at the top of the vessel, but at the opposite end to the liquid, and therefore traverses the chamber in a reverse direction to the latter, which is gradually vaporized by the heat from the pipes as it descends the chamber.

The Proposed Association of Water-Works Engineers.—Our readers may remember that, in a letter in the JOURNAL for the 26th ult., a suggestion was put forward by Mr. D. M. F. Gaskin, M.Inst.C.E., the Water Engineer of the Nottingham Corporation, for the formation of an Association of Water-Works Engineers for Great Britain. Mr. Gaskin informs us that the response he has received, from the publicity given to his idea in this and other professional journals, has been so satisfactory that he is encouraged to take further steps to bring the scheme to a successful conclusion. He has therefore called a meeting in the Exchange Hall, Nottingham, for the 11th prox., at one o'clock, when the subject will be fully discussed, and a Provisional President, Secretary, and Committee will be elected. Evidence of the interest taken in this project by members of the profession is afforded by the fact that Mr. C. H. W. Biggs will present a paper on the Cologne Water-Works after the general business has been disposed of.

Explosions of Domestic Boilers.—Although, from the letter which appeared in the JOURNAL last week, and the correspondence to which reference was made in a paragraph on the 10th inst. (p. 1195), officials of water companies experience some difficulty in complying with the suggestion made in the circular lately issued by the Board of Trade on the above subject, the Directors of the Grand Junction Water Company have been able to formulate a series of precautions, which they have communicated to the consumers in their district. They are as follows: "(1) That all cisterns from which boilers are supplied, and particularly the pipes communicating therewith, should be placed in positions where they are not likely to be affected by frost. (2) That a safety-valve should be fixed on every boiler that has not a loose, moveable lid. (3) That, should the water supply be interrupted from any cause, the fire should be at once withdrawn until the boiler is cold and the water supply has been restored. It is very dangerous to put water into an empty boiler while hot." In making these suggestions at the instance of the Board of Trade, the Directors are careful to point out that the Company have no responsibilities in the matter, and that the precautions to be adopted and carried out rest entirely with the householders themselves. It will be seen from our "Correspondence" columns to-day that the Manager of the Deal Water Company has also issued a few useful suggestions to the consumers in the Company's district.

NOTES.

The Recovery of Bye-Products from the Jameson Coke-Oven.

At the meeting of the North of England Institute of Mining and Mechanical Engineers at Newcastle on the 14th inst., Mr. J. Jameson submitted a paper dealing with the recovery of bye-products in the manufacture of hard coke in the Jameson coke-oven. The author said that, though the patents had now lapsed, he believed the method of recovery of bye-products in open ovens, unless displaced by some process more effectual, would in time come into extensive use. He narrated the history of the process, and gave the results of the experiments made at Felling, in the way of obtaining a supply of ammonia by suction during the process of coke making. The quantity of coke produced was found to be in no way diminished, and the percentage of residual sulphur was reduced. Sir Lowthian Bell made experiments on the quality of the coke, to see if any injury had been done to it for metallurgic purposes by the abstraction of the products; and he found that it was in every respect fully equal to coke made in the ordinary way without the recovery of products.

Hints on Engineering Workshop Practice.

At a recent meeting of the London Association of Foremen Engineers and Draughtsmen, a lecture was given by Mr. W. T. Coates, a Past-President, on "How Not to Do Some Things." The practical character of the lecture may be inferred from the observation of Mr. Coates that his remarks were really an expansion of the word "Don't;" and he had adopted it because he found in engineering workshops it is more frequently used than the word "Do." The first caution was in regard to giving instructions to workmen, as is not unusual, to make a certain thing to a stated size "full" or "bare," as the case might be, when it would be as easy and far more accurate to give a definite size. The lecturer does not appear to have mentioned the practice followed by some designers of deliberately avoiding round figures in measurements, wherever possible, and so compelling the workman to keep to an accurate dimension by rendering it difficult for him to trust to memory. Mr. Coates observed that in a drawing office there are ways which things should not be done, as in making drawings inaccurately, and then inscribing an instruction upon the sheet that only figured sizes are to be worked to, although it is so easy to alter or obliterate figures. Speaking of testing materials, Mr. Coates offered a most valuable observation, as contractors and inspectors are likely to esteem it, to the effect that too much importance is commonly attached to the appearance of bars when broken, seeing that an experienced hand can produce either a crystalline or a fibrous fracture at pleasure. He proved his point by exhibiting some samples of iron, broken from the same bars, but showing different fractures. One end of a piece of Low Moor iron, for example, showed a tough, fibrous fracture, while the other looked crystallized and brittle. Mr. Coates also observed that sufficient care is seldom taken to work steel at a right temperature; the appearance of the heated metal on a dull day and in bright sunshine or a good light covering a difference of temperature of from 700° to 1000°, which is quite enough to account for the very different results indeed being obtained at such times.

Professor Clowes on Explosive Gaseous Mixtures.

At the meeting of the Chemical Society on Nov. 21, Professor Clowes, of Nottingham, read a paper on "The Composition of the Limiting Explosive Mixtures of Various Combustible Gases with Air." This is a subject to which, as readers are aware, Professor Clowes has given special attention. A number of experiments were made with mixtures in varying proportions of each combustible gas with air. A flame was brought into contact with each mixture, sometimes above and sometimes below; and it was noted whether the mixture burnt back independently of the external air. For each combustible gas there was thus obtained a lower percentage below which the mixture would not burn independently, and a higher percentage above which the gas burnt independently only when it was supplied with more air. The limiting percentages were as follows: For methane, 5 and 13; for hydrogen, 5 and 72; for carbon monoxide, 13 and 75; for ethylene, 4 and 22; for water gas, 9 and 55; for coal gas, 5 and 28. It was also proved that many mixtures which were outside, but close to, the above limits, and which could not be fired from above, could be fired from below. Hence it was inferred: (1) That the limiting explosive mixtures for different combustible gases vary widely. (2) That methane shows the narrowest limits; hydrogen the widest limits. (3) That the risk of a mixture being fired explosively increases with the different gases in the following order: Methane, ethylene, coal gas, water gas, carbon monoxide, hydrogen. (4) That the risk of explosion is greater when the mixture is kindled from below than when it is kindled from above.

The Determination of Carbon in Iron.

Herr F. Foerster recently dealt with this subject in the *Zeits. für Anorg. Chem.* Among the procedures which give trustworthy values for the determination of carbon in iron, the copper-ammonium chloride can be executed with the simplest appliances at hand in every laboratory; and it does not make such demands on the experience of the analyst as does the chlorine process. Sometimes its general applicability is interfered with by the fact that some sorts of wrought irons, especially tungsten steels, if in contact with a quite neutral solution of copper-ammonium chloride, give a violent escape of gaseous hydrocarbons. In such cases, the author, instead of a solution of copper-ammonium chloride, uses a solution of copper-ammonium oxalate. This is obtained by mixing a 10 per cent. solution of copper sulphate with a solution of ammonium oxalate saturated in heat until the initial precipitate is re-dissolved. Of this solution, 250 c.c. are poured upon 2 to 3 grammes of the tungsten steel to be analyzed, and heated together in a water-bath at 80° for five hours. Copper separates out, and the liquid takes a green colour. It is decanted away from the residue; the copper is dissolved away with a solution of copper-ammonium chloride when the residual carbonaceous substance, after filtration and drying, is burnt in a current of oxygen.

TECHNICAL RECORD.

THE CHEMICAL PURIFICATION OF ILLUMINATING GAS.

In a previous issue of the JOURNAL (*ante*, p. 977), we gave an abstract translation of a portion of the paper on the above subject, by MM. Delseaux and Renard, for which the authors were awarded a prize of 750 frs. by the Société Technique du Gaz en France. We now deal with the rest of the paper, treating upon purification by lime and other materials, and revivification.

The authors begin by remarking that, in all towns where the suppliers of gas are compelled, by their contracts, to remove the sulphur compounds, purification by oxide of iron alone is found insufficient; and therefore it becomes necessary to use lime. Like oxide, lime is more active hot than cold. In the former condition, its action upon carbonic acid is almost twice as great as it is when cold; while its effect upon sulphuretted hydrogen is very considerably augmented. It is the same with the action of sulphide of calcium upon sulphide of carbon; but the former is more easily decomposed by carbonic acid. These considerations led Messrs. Hood and Salamon to conclude that the lime produced from carbonate of lime prepared hot, is more active than, and therefore preferable to, that coming from calcite. Having explained the reactions which take place in lime boxes, the authors remark that the material is no longer used in the condition of milk of lime, but in a mass; and in this form it may be introduced into the purifiers—anhydrous, slaked, or partially hydrated, but generally without the addition of inert matters, and in several layers. They then pass on to show how purification may be carried on by the simultaneous employment of oxide of iron and lime; and they advise the two following arrangements of purifiers: (1) Lime, sulphide of calcium, oxide of iron; (2) lime, oxide of iron, sulphide of calcium. The first disposition is, in their opinion, the most rational one; sulphide of calcium forming naturally in the second purifier in consequence of the decomposition of that contained in the first. Moreover, it presents more security; for if all the carbonic acid is not arrested in the lime purifiers in one or the other of the arrangements, the sulphuretted hydrogen liberated in the sulphide of calcium purifier will be taken out by the first, and not by the second arrangement.

The authors next deal with purification by Laming material, and give three methods of preparing it—one being that in use at the works of the Paris Gas Company. As there prepared, it consists of the following ingredients: Sulphate of iron, 250 kilos.; slaked lime in powder, 4 hectolitres; inert material, 7 hectolitres. A current of gas was passed through a mixture made in this way; and the result showed its great activity, when newly prepared, alike upon hydrosulphuric and hydrocyanic acid. The authors explain the latter fact by the presence in the mass of a certain quantity of protoxide of iron more active than the sesquioxide, and not transformed into that salt—the material having been brought into use several hours after its preparation. A few remarks are next offered on the purification of gas by the residual oxides of iron produced in the manufacture of sulphuric acid or aniline; but the results obtained show that this material has not anything like the activity of the hydrated oxides. Purification by the oxides of iron in the presence of alkalies is then considered; reference being made to the processes of Leybold, Knublauch, and Foulis. The authors consider that the methods adopted by the two last-named gentlemen have the drawback of being wet ones; and therefore an attempt was made to obtain by the dry way the advantages they procure. The material called "Lux masse" may, they think, rank among those attaining this object.

At first, an attempt was made to employ mixtures which when placed in ordinary purifiers were capable of completely arresting the hydrocyanic acid as well as the sulphuretted hydrogen. In one works, the following combination was tried: Natural oxide of iron, 2200 kilos.; soda crystals, 2200 kilos.; iron filings, 880 kilos.; sawdust, 44 hectolitres. This was submitted for 103 days to the action of the gas to be purified. The quantity of gas passed through it was 975,240 cubic metres (about 34⅓ million cubic feet); the purifying surface being 55½ square metres per 1000 cubic metres of gas per day, and the time of contact 2 min. 46 sec. In the works where this trial was made, continuous revivification by air was employed;

the purifiers being arranged in series of four. Although the sulphuretted hydrogen did not reach the purifier containing the material, this did not completely arrest the hydrocyanic acid. The authors tried a similar combination, but containing free sulphur, in the last boxes at a works where there was no addition of air. Instead of making up fresh material to which sulphur would have been added, they made use of stuff which had been three times in the purifier, and with which they mixed iron filings and carbonate of soda instead of soda crystals, with the object of obtaining a more homogeneous and less humid mixture. As prepared, the mass was put into the purifier with 18·50 per cent. of water. It was thought that, under these conditions, by avoiding too large a formation of sulphocyanates, the hydrocyanic acid would be no longer left in the gas. But, after some hours, traces of it were found; and it was presumed that the quantity would increase. The authors thereupon sent in first unpurified and then purified gas; in other words, they made the outlets inlets for a few hours, and then changed them back again until the presence of cyanides was detected. In this way the hydrocyanic acid was completely arrested; and the conclusion was come to that sulphide of iron in the nascent state, so to speak, is more active than a mixture of sulphur and iron. Subsequent trials justified this conclusion; and, in the authors' opinion, they demonstrated the inutility of working with alkaline mixtures. They consider that the arrangement of the purifiers in series of four, of which three are in use successively and one is off, is preferable to series of two, for retaining the largest possible quantity of hydrocyanic acid. This arises from the fact that, in the series of four, the first one contains sulphide of iron, which is very susceptible of taking up the acid.

Purification by salts of iron and ammoniacal liquor is next briefly touched upon; and the authors conclude the first part of their work by giving the prices of some of the purifying materials they have been considering.

In the second part of their paper, the authors deal with the revivification of spent materials. They begin by pointing out that, for effecting this object, oxygen, either pure or in the form of gaseous mixtures, may be employed. They show, by means of formulæ, the changes which take place in oxide of iron when used for the purification of gas, resulting in the formation of ferrous oxide, in which condition it will rapidly absorb oxygen to reproduce ferric oxide. The secondary reactions relative to the production of prussian blue are noticed; and then the authors describe the three methods of treating spent oxide—in the open air, *in situ*, and in the purifiers by the continuous system. With regard to the first, they do not agree with spreading the material in very thin layers and watering it as soon as removed from the boxes, unless the object is to produce prussian blue. They consider the practice defective where the idea is to effect the decomposition of the sulphide of iron. They think the stuff should be kept in a heap, so as to cause a certain rise of temperature to facilitate the various reactions; then spread out in layers from 8 to 12 inches thick; and turned over from time to time to expose fresh surfaces to the air. Revivification—generally a very slow process—is facilitated by dry and warm weather. The authors demonstrated this by some experiments, the results of which are tabulated. When revivifying in the open air, it is always the upper surface of the oxide which is in contact with the atmosphere. This fact led to open-work flooring being devised, to admit air to the under side of the mass; and this again led to the system of purification *in situ*. In the latter process, the purifier being thrown out of action, air is sent through the vessel. If the air is dry, revivification will be effected in 27 hours; if it is humid, in about twice this period. Dry air should, however, only be employed very cautiously. If ample time can be allowed for the revivifying operation, the authors consider it preferable to employ moist air. Various plans have been introduced to attain this end—such as putting water in the bottom of the purifier, moistening the material itself, or sending in a jet of water with the air. The introduction of air into the unpurified gas affects the removal of the cyanogen compounds by oxide of iron. Two samples of oxide were submitted by the authors to the action of crude gas without the addition of air and with 2 per cent. of air, with the result that without air the percentage of prussian blue was 2·46, whereas with air it was only 1·26; the proportions of total sulphur being 22·42 per cent. without, and 29·58 per cent. with air, and of free sulphur 11·81 and 18·81 per cent. respectively. The third process of revivification—that by oxygen—which the authors say is becoming general, is fully dealt with. The inconvenience attending revivification by the continuous and intermittent systems alike is the caking of the material. This is by some attributed to the fusion of the sulphur in it; but the authors are of opinion that the trouble results simply from getting rid of the humidity.

The use of steam for the purpose of revivification is the next branch of the subject taken up; and Mr. F. G. Dexter's labours in this connection are here mentioned. The authors made a trial of continuous revivification on two lots of material—one with the addition of steam, and the other without. In the latter case, the quantity of gas purified was 344,960 cubic metres (about 12¼ million cubic feet) in 42 days; and the following results were obtained: Humidity, 8·70 per cent.; total sulphur, 8·25 per cent. of dry material; free sulphur, 6·82 do.; sulphuric acid, 0·17 do.; sulphocyanic acid, 0·13 do.; prussian blue, 2·65 do. In the former case, the material had purified 583,910 cubic metres (20½ million cubic feet) in 59 days; and the following results were obtained: Humidity, 13·20 per cent.; total sulphur, 20·66 per cent. of dry material; free sulphur, 16·55 do.; sulphuric acid, 0·26 do.; sulphocyanic acid, 1·08 do.; prussian blue, 3·57 do. An inconvenience attending the use of steam the authors found to be this—that, consequent upon the maintenance of the humidity at a tolerably high temperature, the production of bisulphide of iron was favoured, and thus a portion of the oxide was rendered inactive.

With regard to the revivification of spent lime, the authors remark that pure oxygen is the only agent recommendable in this case. Not only has it a more energetic action than air, but any slight excess left in the purified gas really increases its illuminating power. The oxygen should not, like the air, be introduced at some point as near as possible to the hydraulic main, but at the very inlets to the purifiers; the washer-scrubbers being capable of absorbing 13 to 20 per cent. of the volume used.

MM. Delseaux and Renard conclude this part of their work by remarking that the object sought to be attained in the various methods of revivification dealt with has been to economize labour in the handling of the materials. Continuous revivification in the boxes was a great advance in purification. But whichever of the systems may be employed, one is compelled, at more or less frequent intervals, to remove the material; and consequently a good arrangement of purifier-house and revivifying-floor, requiring as few hands as possible, will, of course, reduce the expenses to a minimum. The authors cite a few figures to show the cost of purification per 1000 cubic metres of gas by various systems.

The third part of the paper consists of a number of analyses of spent materials, and the general conclusions arrived at by the authors. These may be shortly summed up as follows:—

Removal of the Sulphur Compounds.—Where oxide of iron is used, there should be a large purifying surface and prolonged contact with the purifying material, which should be in one or several layers according to the use or non-use of inert materials. Where revivification is effected in the open air, the material should be heaped up on its removal from the purifiers, and, as soon as it becomes heated, spread in layers from 8 to 12 inches thick. Where continuous revivification is employed, the volume of air or oxygen should be injected without interruption, and in exact proportion to the make of gas; the material to be kept warm and moist. In the case of purification by lime, the material should be divided into several layers, and used cold if it is desired to retain more of the sulphide of carbon, otherwise hot. Oxygen to be employed for revivification.

Removal of the Cyanogen Compounds.—To ensure material rich in prussian blue, keep the stuff very moist at a low temperature; have a large purifying surface, and long contact. When revivifying in the open air, spread the material in very thin layers kept quite moist; but if *in situ*, inject cold air, saturated with moisture, at great speed. In the case of continuous revivification, the opposite process must be adopted, owing to the presence of less sulphide of iron in the purifiers.

Removal of Carbonic Acid.—Here lime purification should be adopted; the material to be hot, and divided in several layers. No special system of revivification need be followed.

CARBURETTED WATER GAS WITHOUT OIL.

By Frederic Egner, of St. Louis (Mo.).

[Prepared for the *American Gaslight Journal.*]

When, during the past summer, the price of gas oil was advanced, in our case, 33⅓ per cent., thereby adding 10 c. per 1000 cubic feet to the cost of making, "without any effort on our part," we at first went back to making a mixed (coal and water) gas, as a possible remedy, with decidedly encouraging results. We also tried making water gas enriched with cannel instead of oil gas. Now, this was not a new thing in the writer's experience, and possibly it would not be unknown to many of the readers of the *Journal*. Still, as the matter might be of general interest, the facts are given.

The works are provided with one set of the improved Lowe double-superheater type of water-gas apparatus, a double set of the Granger-Collins kind, and a complete, good (though not modern) coal-gas plant, besides ample purifying and storage capacity—especially so in respect of the latter. The water gas goes from the scrubber and condenser of the generating apparatus to a primary or relief holder, from which it is taken by an exhauster, and pushed through a second condenser, the scrubber, the purifiers and station meter, into the holders. The coal gas goes direct from the hydraulic main to the exhauster, where it meets, at the inlet, the water gas from the relief holder. The speed of the exhauster is regulated by a home-made, but absolutely reliable and effective, governor; and the pipe from the relief holder to the exhauster is provided with a convenient valve. These simple details are given because it is believed they will conduce to a clearer understanding of what follows.

Upon a certain morning, having then on hand more finished gas than could be used in the town for the next 24 hours, we started our trial of making carburetted water gas without oil. We had in action four benches of fives making coal gas, and had our relief holder (previously completely exhausted) filled

with "blue" water gas—that is, water gas made from the decomposition of steam by means of incandescent retort-house coke, without oil, in a Lowe-Collins water-gas apparatus. To produce 1000 cubic feet of the above-described uncarburetted water gas required 60·6 lbs. of gas coke, including the fuel used under the boiler—carburetted water gas requires, in our case, about 18 lbs. less. It was also found that, instead of making an average of about 4580 cubic feet of gas per run in each generator, the quantity was reduced to an average of 3140 cubic feet, or from 15,600 to 13,200 cubic feet per hour for the set. Let it be well understood that no oil whatever was used in making the blue gas.

Our custom in making coal gas is to draw and charge as many retorts in several of our four benches each hour as would be equal to one bench together. This system possesses certain advantages for both workmen and the Company, be the works large or small. We commenced charging the retorts with a reduced weight of cannel, two hours before beginning to mix the gases, and then opened the valve between the relief holder and exhauster until the Lowe jet photometer close by, and used for the purpose, indicated 22·5-candle power. It was found that, with a combination of 43·6 per cent. of cannel and 56·4 per cent. of blue water gas, the above average illuminating power could be easily maintained, while at the same time practising the revivification *in situ* method in our purifiers.

It may be remarked in passing that we have run our purifiers for upwards of seven months without once raising the covers—and that is going pretty close to purifying in closed vessels; and the only cost on account of purification was the first cost of the material. What that was is of little consequence, since the whole thing hinges upon the manner of using what one can buy or make as may be most convenient or cheapest.

The cannel used yielded something like 23 gallons of tar per ton, which is worth 5 c. per gallon, to burn in lieu of coke, whatever it may be worth to sell. We are obliged to gauge the value of our tar by its fuel value. This cannel also produced 1100 lbs. of really first-rate coke per ton, besides considerable breeze. The coke was more than was required for fuel in the benches and under the boiler, which, of course, is not saying much; but it should be remembered that our benches, though good, were not by any means modern. In consequence of this, perhaps we did not obtain the yield of gas per pound which the cannel was said to contain. We have no means of utilizing our ammoniacal liquor; and hence this valuable bye-product goes to waste.

It was stated that we use gas coke in our generators. Therefore the question may naturally be asked, "How much is that worth?" We find it to be worth at least as much as good anthracite would be to us; and though that might be the ready answer given, it might not be entirely correct. Let me put it in this way: "How much does gas coke cost the producer?" Suppose we were to figure, for example, as follows: 1000 cubic feet of [?] candle power carburetted water gas might cost us, for material alone, say, 38 c. Remember, gas oil is away up in some sections of the country. Now, a ton of a certain kind of coal might produce (say) 9000 cubic feet of the same candle-power gas as the above-named sample of water gas; hence the gas from this ton of coal is worth $9 \times 38 - 90$ (the cost of labour to produce it) = $2·52. The same ton of coal will produce 14 gallons of tar, which, at its value to burn, is worth 5 c. per gallon, or 70 c. We now have $2·52 + 70 = $3·22 of value obtained from the ton of coal, which, in this supposable case, cost us to begin with just $3·05. This same ton of coal may yield 1300 lbs. of coke, of which 35 per cent. may be used in production; and we have left 845 lbs., which has not only cost nothing at all, but actually (?) came with a profit of 17 c. to boot. These figures ought to be gone over by acetylene enthusiasts, or others (with whom the former, however, should not be classed), who periodically appear with "gas for nothing" schemes.

This experiment has demonstrated to our satisfaction that carburetted water gas can be made without oil. There need be no apprehension that the gas will stratify in the holder. The verdict of many of our consumers, after using this gas, may be described by some of their exclamations next morning, such as: "What have you been doing with your gas?" "We never have hitherto had such good gas!"

[We learn that the cannel coal referred to in the above experiments is "Bear Creek" cannel, supplied by the Log Mountain Coal Company, of Pineville, Ky.—Ed. J. G. L.]

A Town Lighted by Water Gas.—The small town of Valkenburg, near Aix-la-Chapelle, but on the Dutch side of the frontier, is lighted, according to the *Journal für Gasbeleuchtung*, with uncarburetted water gas. A concession was granted to Dr. H. Strache, of Vienna, to set up a water-gas installation for lighting according to his system (see Journal, Vol. LXIII., p. 527; and Vol. LXV., p. 218). The street-lamps have an illuminating power of about 105 English candles, and are placed at intervals of 100 to 150 feet. A light of about 90 candles costs private consumers as near as possible 4d. per 15 hours. The water gas is made in special generators from coal or lignite. This is the first instance of a town installation of non-carburetted water gas on Strache's system.

STORAGE BATTERIES v. GAS-ENGINES.

At a recent Meeting of the American Institute of Electrical Engineers, the following paper on the relative economy of storage batteries and gas-engines as auxiliaries to electric lighting plant was read by Mr. Nelson W. Perry:—

Whether or not it is economical to equip a central station with an auxiliary storage battery plant is a question which must be decided separately for each particular installation. Generally speaking, the question will be decided by the character of the load-line—a broad-topped curve being the most unfavourable, and a sharp peak the most favourable to storage battery economy. Again, a station having a very light day load may use the battery to good advantage, even though its night load may present a broad-topped aspect. Apart from purely economic reasons, convenience may be controlling; so that it is impossible to state, unless all the conditions are known, whether or not the storage battery is advisable. The price of the battery is an important element, of course, but less so than is popularly supposed; for the space it occupies and the cost of maintenance may largely overbalance any gain in first outlay over the cost of the extra boiler, engine, and dynamo.

In regard to the cost of maintenance, manufacturers are willing to guarantee that it will not exceed 10 per cent. per annum. But it is well to understand just what this 10 per cent. means. It means, in the first place, that if you put in all the battery power the manufacturer recommends, and take care of the battery exactly as he says, then the guarantee holds good. Under such conditions, the manufacturer is undoubtedly on the safe side; but if we instal a plant under these conditions, we are pretty sure to find that the economy effected in the first cost of the storage battery over the engine and dynamo has entirely disappeared.

Then it is well to understand beforehand what the 10 per cent. means—10 per cent. of what? The public are given to believe that this means 10 per cent. of the cost price of the batteries; and the statement has been freely made that this is what it does mean. Some time ago, I had occasion to inform myself accurately on this subject, and to this end entered into correspondence with the President of the leading storage battery company of America. As regards the guarantee, he said they would undertake to provide renewals, when required, at a specified price, and would give an assurance that they would not exceed an average of 10 per cent. per annum. He added that he had every reason for believing that the actual cost, when the batteries were used at normal rates, would not exceed 5 per cent. The Company's catalogue, however, stated that they were prepared to undertake maintenance contracts according to a scheduled rate of charges, for periods up to ten years or longer, under which they would guarantee that the total amount paid for renewals during the term of the contract should not exceed 10 per cent. per annum on the catalogue price of the cells specified in the contract. But it was specified that in all cases of renewal by contract, the old material becomes the property of the Company, and must be returned to their works free of charge for carriage or packing. Since the regular trade discount at that time was 20 per cent. of the catalogue price, and a further discount was offered which made the cost of the batteries comparable with that of an engine and dynamo, the guarantee assumed a very different aspect from that which it bore on its surface. When to this was added the cost of packing and carriage back to the factory, it ceased to be an attractive guarantee; and my calculations showed that in many cases where the storage battery might be recommended, if the guarantee was what it appeared to be, it would not be economical under the guarantee as it actually was.

As before indicated, there are some situations in which either convenience or extreme steadiness of current may be controlling in deciding the question of the use or not of storage batteries. But where the question is one purely of economy, I would not myself recommend their use under any circumstances, simply because there is a still more economical method at hand. I refer to the gas-engine. Even if it were necessary to use illuminating gas from the street mains, it would be more economical (considering space and other factors coming into the question) to take the peak of the load with a gas-engine than to instal a storage battery for this purpose. There would be no stand-by losses; and the engine would be ready at a moment's notice to be brought into service.

It is a fact that has been amply demonstrated by others as well as myself, that a given number of lights can be produced with half the gas burned in a gas-engine that is required to produce them in ordinary burners. The mechanical efficiency of the gas-engine is not quite so high as that of large compound condensing steam-engines—rarely exceeding 83 to 85 per cent., while the latter may go to 90 per cent. But the total efficiency, from the fuel to the pulley of the gas-engine, is about double that of the steam-engine—reaching 25 per cent. under favourable conditions, whereas with the steam-engine it rarely equals 12 per cent. So that with the gas-engine, operating at anywhere near its full load, there would be a gain in efficiency, instead of a loss of somewhere about 20 per cent. where the storage battery was used.

As indicating the performance of a gas-engine using lighting

gas at various loads, I quote the following figures obtained from a test of a 12-horse power (actual) gas-engine :—

Actual Horse Power Developed.	Gas Consumption per Horse Power.	Actual Horse Power Developed.	Gas Consumption per Horse Power.
12	15·0 cub. ft.	6	18·0 cub. ft.
11	15·3 ,,	5	19·0 ,,
10	15·5 ,,	4	21·0 ,,
9	16·0 ,,	3	26·0 ,,
8	16·5 ,,	2	30·0 ,,
7	17·0 ,,	1	48·0 ,,

These figures are somewhat better than would be obtained in practice; but they go to show that the gas-engine compares favourably at light loads with the steam-engine under similar conditions.

Thus far I have spoken only of illuminating gas; but the power may be much more cheaply generated by using fuel gas. The cost of producers or generators comes to about $11 per horse-power capacity—considerably less than the cheapest boiler. An idea of the space required may be gained from a statement of Mr. J. Emerson Dowson, who, in estimating for a plant of 400-kilowatt capacity, says that, if the gas plant is all on one level, it would occupy a ground space of 27 feet by 54 feet. But, if necessary, all except the gasholder can be placed under or over the engine-room. His estimate for such a plant is, including erection, foundations, and ashpit for the generators, $10·38 (£2 3s.) per horse power. These fuel gas generators can utilize advantageously the poorest grades of fuel, and produce from the better grades of anthracite about 160,000 cubic feet of gas, of a calorific value one-quarter that of 16-candle power illuminating gas, per ton of coal.

As to the stand-by losses of the gas-producers, these have been very carefully determined in a number of cases. As an illustration, I will cite a single case—by no means the best on record. At Openshaw, a generator, which supplied gas for from 250 to 300 indicated horse power, was shut down for 41 hours, and the fuel consumption during this time was but 3·9 lbs. per hour, or about 1 per cent. When we compare this with the stand-by losses of the steam-boiler, which are estimated by Professor Kennedy at 10 per cent. of the total consumption in all the boilers, we see how insignificant it is.

A situation usually considered peculiarly adapted to the storage battery is in subordinate or outlying stations, where they are charged during the daytime from the central station, and act as centres of supply during the night. But gas can much more economically be distributed to these stations than can the electric current; for Mr. Denny Lane has shown that, with ordinary 16-candle power gas, 3000-horse power can be sent a mile for an expenditure of 1-horse power, or 1-30th of 1 per cent. of the power conveyed.

My own calculations show that a 6-inch pipe will deliver 6000 cubic feet of gas per hour, at a distance of 10,500 feet, under 4 inches water pressure. If this is 16-candle power gas, allowing 25 cubic feet per horse-power-hour, this quantity represents 240-horse power.

Cast-iron pipe 6 inches in diameter, having a thickness of inch, weighs 31·9 lbs. per foot. The total weight of this two miles (nearly) of pipe will therefore be 334,950 lbs. This would be equivalent in conductivity to about 41,869 lbs. of copper. But four miles of copper weighing 41,869 lbs. would be equivalent to about four No. 000 B. & S. wires, which would have a resistance for the four miles of 0·325 ohms. If the charging current were transmitted at 220 volts, there would be required a current of 848 ampères. But a wire having a resistance of 0·325 ohms will only deliver, under a pressure of 220 volts, 667 ampères. There would, therefore, be required five No. 000 B. & S. wires to deliver this energy; and the weight of this would be 53,540 lbs. If the distribution took place at 1000 volts, the ampères required would be approximately 180. To deliver this at the same distance with a loss of 10 per cent. would require 6264 lbs. of copper; to deliver it at 1 per cent. loss would require 62,642 lbs., which would cost far more than the pipe, and still give less efficient transmission.

I think it would be very easy to prove that the gas-engine, with fuel gas, would prove a much more economical auxiliary to the central station for taking the peak of the load, and the loads amounting to fractions of a unit, than the storage battery; and when we consider the efficiency of transmission of energy in the form of gas, which will permit of the location of the gas-generators where land is cheap and fuel easily procured, it seems to me that the plan must commend itself to electrical engineers.

Unfortunately, the gas-engine business in America seems to be in the hands of parties totally incompetent to handle it properly, as everyone knows who has ever had occasion to seek information from them. It is probably not too much to say that every attempt thus far made in America to adapt the gas-engine to electric lighting has proved a failure. Our own manufacturers either do not know what their engines are capable of doing, or else they are afraid to make public what they will do. I believe there is not a single manufacturer who has a printed price list; and my own experience (and that of others whom I know) has been that it is impossible to get prices quoted until the manufacturer or his agent has been thoroughly satisfied of the exact purpose for which the quotations are desired. Information of any kind is almost impossible to get; and guarantees of performance, when given, are worthless. To such an extent is this true, that nearly all, if not all, the recent large orders for gas-engines have gone abroad, where the business is conducted on business principles. In England, Germany, and France, the gas-engine has come into extensive use in isolated lighting, and already has been adopted with satisfactory results in several central stations of considerable size. When the business is properly handled in America, we may expect to see the gas-engine make its way rapidly in the lighting industry there also; for it has merits which need only to be known to be appreciated.

A SPECTROSCOPIC STUDY OF OXY-COAL GAS.

Some time ago, M. Jean S. Stas undertook a series of spectroscopic studies of various elements; using, in his fundamental experiments, air, oxygen, hydrogen, and coal gas. A translation of his work in which the results are recorded is now appearing in the *Chemical News;* and we extract therefrom the portion relating to the spectroscopic examination of the oxy-coal gas employed.

When the air is pure, coal gas taken direct from the main burns in a Bunsen burner, or blowpipe, or blowpipe fed with air or oxygen, without showing a trace of the sodium line on spectroscopic examination. During my examination of the coal gas spectrum, I tried whether the presence of compounds of ammonia or cyanogen modified it. With this view, I examined the spectrum of oxy-coal gas, made with gas either taken direct from the main or kept in a gasometer where it was stored, having been previously deprived of compounds of ammonia and cyanogen by its passage through flasks filled with broken pumice-stone, and moistened respectively with a strong solution of caustic potash and sulphuric acid diluted with its volume of water. I have never detected any difference between the spectrum shown by ordinary gas and that by gas purified as above.

With the object of economizing oxy-hydrogen gas as much as possible, on account of the difficulty of preparing hydrogen fulfilling all requirements, I often used oxy-coal gas to eliminate from compounds the sodium which is accidentally contained in them. I also used the oxy-coal gas blowpipe (which is very much easier to manipulate) to check the results given by the oxy-hydrogen burner. These requirements led me to examine the oxy-coal gas jet formed from coal gas under pressures respectively of 4 and 5 centimetres of water. The results having been the same, I shall limit myself to mentioning here those obtained under constant pressure of 4 cm.

When the internal surfaces of the service-pipe and burner were thoroughly moistened, the gas-jet issuing from a platinum burner, with a hole 1 mm. diameter, formed a luminous flame 25 cm. high and 1½ cm. diameter. When the supply of oxygen was regulated so that all luminosity disappeared from the flame, its height was reduced to 17 cm., and its diameter to 7 or 8 mm. In pure air, this flame is deep pure blue, without an inner cone. Spectrum analysis of it shows an absolutely dark spectrum. On gradually increasing the supply of oxygen, the colour intensity of the flame decreases, and the light intensity increases. Instead of deep blue, it becomes sky-blue. It develops at the same time a highly luminous inner cone, pure light blue in the absence of sodium, and pale blue tinged with green whenever it has the least trace of sodium in it.

Spectrum analysis of the sky-blue flame and of the inner cone reveals a hydrocarbon spectrum. I found that the luminous intensity was greatest, and the spectrum most complete, when the inner cone was reduced from its original height of 9 or 10 cm. to about 5 cm. Whatever the height of the inner cone might be, the appearance of its spectrum is the same. It consists of six well-marked bands, shaded from left to right; one reddish-brown band, two bands of different shades of green, and three pure blue bands. The bands are defined by lines, the number of which varies with the luminous intensity of the cone. With maximum intensity, examining the apex or one side of the cone, the bands are made up as follows: (1) The red band—composed of four sharp very bright lines, situated between 43 and 49 on the micrometer of my Steinheil spectroscope. (2) The first green band—composed of four sharp very bright lines, situated between 56 and 66 on the micrometer. (3) The second green band—composed of three very bright lines, situated between 72 and 77. (4) The first blue band—composed of five sharp lines, less bright, situated between 90 and 96. (5) The second blue band—composed of four faint lines, situated between 113 and 115. (6) The third blue band—nebulous and very faint, extending from 117 to 118. When the luminous intensity was not at its maximum, but yet the bands were broken up into quite distinct lines, the second green band consisted of only two lines, and the first blue band of only four lines, instead of three and five lines respectively.

The coal gas spectrum generally recognized appears then to be an incomplete spectrum. The connection between the number of lines in the coal gas spectrum and its luminous intensity is undoubted; and the influence of a rise of temperature on them both seems to me indisputable.

I made a set of experiments to ascertain what influence the lines in the coal gas spectrum had on the spectra I was studying under different conditions; and I found out definitely that the spectrum of sodium, potassium, thallium, lithium, calcium,

strontium, and barium is the same when rendered incandescent either in an *oxy-hydrogen* or *oxy-coal gas* blowpipe.

Having obtained the coal gas spectrum, it suffices to place a compound of sodium, potassium, thallium, lithium, calcium, strontium, or barium in the desired part of the jet, in order to extinguish completely all the lines in the spectrum, and replace its characteristic bands and lines by the lines of each of these metals. Doubt is only possible in the case of the green lines shown at a very high temperature by barium compounds. This metal itself has a band made of very fine green lines, as observed by M. Bunsen, that might be mistaken for the green lines in the coal gas spectrum.

The rays from the metallic compounds I have just mentioned extinguish—that is, render invisible—the rays from coal gas burning in oxygen. The vapours of thallium and sodium, especially thallium, extinguish the lines of coal gas most easily; but one must raise the vapour of barium compounds to the highest possible temperature before it will make a coal gas spectrum completely disappear. Besides this, one finds in some of these bodies this property of extinguishing others.

THE PRODUCTION AND USE OF ACETYLENE.

The November number of the *Journal* of the Society of Chemical Industry contained the following abstract translation, by Professor D. E. Jones, of an article in the *Elektro-chemische Zeitschrift* on the above subject:—

The heat of formation of acetylene is −47,750 calories. This amount of heat is absorbed when 24 grammes of carbon and 2 grammes of hydrogen unite to form 26 grammes, or 22·33 litres, of acetylene. This negative heat of formation can also be deduced from the fact that in the reaction—

$$C_2H_2 + O_5 = 2CO_2 + H_2O,$$

310,050 calories are evolved. For the heat of formation of $2CO_2$ is equal to 194,000 calories, and of H_2O is equal to 68,300 calories. These together amount to 262,300; and the difference between this and 310,050—viz., 47,750 calories—is absorbed in the synthesis of acetylene. The Neuhausen Aluminium Company offer calcium carbide wholesale at the rate of 40 pf. per kilo. (about 2·2d. per lb.). It is stated that 1 kilo. on an average produces 275 litres of acetylene. Since 1 kilo. of pure calcium carbide should yield 348·9 litres of acetylene, the Neuhausen product really contains about 79 per cent. of calcium carbide.

In the electric furnace, the carbide is a viscous fluid. On cooling, it solidifies to a bronze-brown or grey crystalline mass as hard as granite. In demonstrating the preparation of acetylene, about 50 grammes of the carbide should be placed in an Erlenmeyer's flask provided with a stoppered funnel, from which water is allowed to drop slowly. In the decomposition of the carbide, the volume increases greatly, and much heat is evolved. The residue consists of calcium hydrate mixed with only a few specks of carbon. The carbide needs to be kept in well-stoppered bottles made tight with paraffin, for it is decomposed by the aqueous vapour always present in the air.

If acetylene be required for a series of experiments, it should be collected over a concentrated solution of common salt in a glass gasholder containing about 10 litres. [Water at 18° absorbs about its own volume of acetylene; whereas 100 volumes of the above solution only absorb about 5 volumes of the gas.] Acetylene condenses to a colourless liquid (sp. gr. ·42) under much the same conditions as carbon dioxide. Its critical temperature is 37°, and its critical pressure is 68 atmospheres. A Mannheim firm is already preparing to supply liquid acetylene in steel cylinders. Acetylene is about as poisonous as carbon monoxide, of which 0·4 per cent. is fatal; but it fortunately possesses a most characteristic smell. The presence of acetylene can be detected chemically by the formation of its silver compound ($C_2HAg \cdot AgOH$), which falls as a yellow precipitate when the gas is passed into an ammoniacal solution of silver nitrate.

To demonstrate the high illuminating power of the flame of burning acetylene, we only require very simple apparatus—a glass test-tube standing on a foot, and provided with a stopper through which passes a glass tube. The lower end of the tube should be cut on a slant, and provided with a side opening, so that condensed water may easily drop off. Its upper end should be provided with a platinum tube squeezed at top so as to leave a slit-shaped opening. About 3 grammes of calcium carbide are placed in the test-tube, and a few drops of water added. The stopper is pushed in, and the gas lighted.

An efficient illuminating agent should not only produce a bright light, but should also be cheap; and the products of combustion and the heat evolved should be comparatively small. All these factors are affected by the construction of the lamp or burner. Schülke's "Regina" lamp is well adapted for burning pure acetylene. The cost for a given number of candle-power-hours is about the same as when petroleum is burnt in the same lamp. But acetylene produces only one-third the amount of heat and one-fifth the amount of carbon dioxide. Light for light, acetylene is about 55 per cent. cheaper than electric glow lamps. With the arc light it cannot compete in cheapness, although it has the advantage of being more easily handled, and of sufficing in many cases where the extreme brilliancy of the arc light is not required.

The author gives a detailed comparison of the efficiency of various illuminating agents, accompanied by tables showing the consumption, price, number of calories and of cubic metres of carbon dioxide evolved per 100 candle-power-hours. In the following table, typical sources of light are arranged in order according to the number of candle-power-hours which can be provided at the cost of one mark:—

Wax	33
Stearine	77
Incandescent electric light	440
Coal gas (slit burner)	625
Acetylene and air (slit burner)	716
Oil gas	1660
Water gas and benzene	1666
Electric arc	2232
Schülke's petroleum-gas lamp	2250
Auer burner with coal gas	2300
" " with water gas	4350

In making such a comparison, it is necessary to bear in mind that the introduction of improved burners and mantles has greatly improved the efficiency of ordinary gas as an illuminating agent for both indoor and outdoor work. The Auer incandescent light only requires 112 litres of illuminating gas to produce 57-candle power (normal) per hour. Even if we allow for deterioration of the mantles, this only comes to 4·34 pf. per 100 candle-power-hours. Fed with water gas, the burner will give the same amount of light at a cost of only 2·30 pf. Whether acetylene in combination with water gas can compete with this remains to be seen.

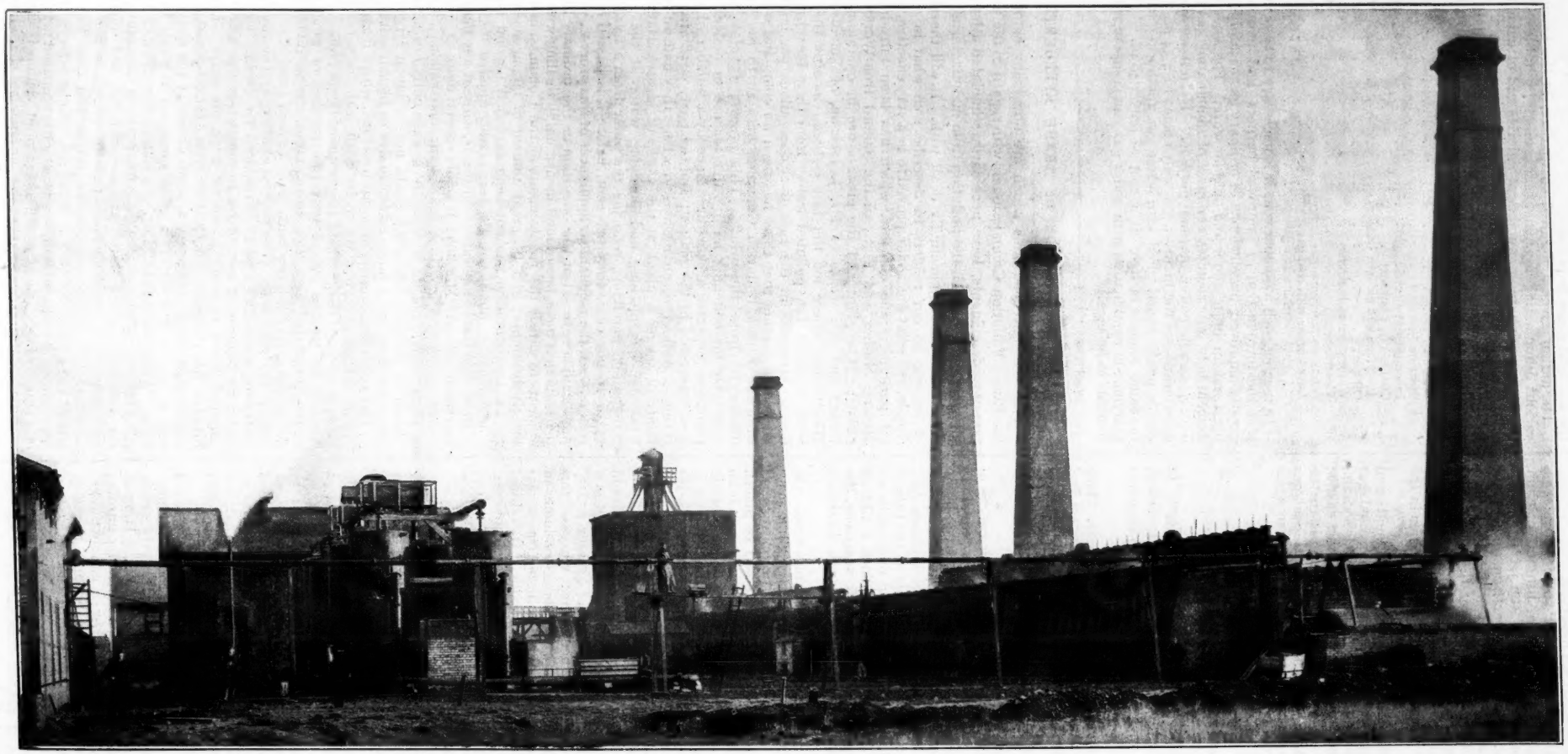
THE PURIFICATION OF TRADE EFFLUENTS.

The stringent conditions which are now being enforced by the Rivers Pollution Commissioners with regard to the purification of trade effluents, have necessarily stimulated attention to all processes by which the pollution from manufacturing operations can be most effectually dealt with. It will therefore be of interest to our readers to describe somewhat in detail a simple, and what has so far proved to be a very effective, process for purifying trade effluents, which has been introduced by Messrs. Mather and Platt, of the Salford Iron-Works, Manchester. The plant and the process are in operation at the bleach and dye works of Mr. J. Jackson, of Smedley, near Manchester, where for the last eighteen months they have been treating the polluted waters from their bleaching and dyeing processes at the rate of 20,000 gallons per hour in so efficient a manner that there has been no complaint whatever from the Rivers Pollution Commissioners as to the effluent discharged from the works. This process is also equally adaptable for softening hard water for use in boilers. The plant was inspected a short time since by a number of gentlemen interested in the matter; and the party were afterwards taken to Adlington, near Chorley, where they had an opportunity of seeing a plant at the works of Messrs. Davies and Eckersley for softening and purifying water at the rate of 8000 gallons per hour; reducing the water from a hardness of 15 or 16 per cent. to 3 per cent. before it is passed into the boilers. All the mechanical appliances of this process, which is practically a reversal of the operation in the ordinary filtering methods that have been found ineffectual in dealing with trade effluents to satisfy the requirements of the Commissioners, are extremely simple; and no great amount of labour is required. So far the operation has not been extended beyond treating trade effluents; but it can be very readily applied for dealing with sewage from moderate-sized towns, without any materially increased labour. Moreover, it would cost no more to deal with 20,000 gallons at one time than with 2000 gallons; and the appliances required for treating the sewage outfall of a town of 20,000 to 30,000 inhabitants would not be much larger than those put down for a fairly extensive dye or bleach works.

The apparatus consists of a cast-iron tank, where from 5000 to 10,000 gallons per hour are to be dealt with; or a brick-built tank, or series of tanks, where larger quantities of polluted water have to be treated. Each tank (the number of which is, of course, regulated according to requirements) is divided into two equal parts; the two tanks thus formed being fitted up in exactly the same way. The process of filling and clarifying—or softening, where the system is required for dealing with hard water for boilers—is carried on in one, while the clarified or softened water is being drawn off from the other. The polluted or hard water is admitted to either tank by means of a supply-pipe, connected up to a pump or main; the water being run in up to a level of a gauge-mark on the side of each tank. While the tank is filling, quicklime and sodium carbonate (58 per cent. ammonia alkali), in proportions depending upon the character of the water, are weighed out, and boiled up with water in a small chemical tank by means of live steam. The lime is first slaked in the hot water, and then the alkali added and stirred up until it dissolves. Some waters require the addition of a little aluminoferric, which is prepared in the form of a standard solution of which a measured volume is added to each tank of water immediately after the chemical-shave been run in. When the tank is full, and the inlet-valve has been closed,

THE DURHAM COKE AND BYE-PRODUCTS COMPANY'S WORKS AT LANCHESTER.

[*For Description, see p.* 1341.]



steam from the boiler is admitted to a blower, causing a current of water to circulate through a rose and a three-way cock, down a vertical pipe, and back into the tank through the perforations in a row of horizontal pipes about 18 inches above the bottom. On turning a small tap, the chemical solution is slowly drawn into the circulating current, and thus diffused throughout the body of the water. A cock is then opened to admit air through the pipe at the top of the blower; and by reversing the three-way cock, this air is forced through perforations on the under side of a row of pipes lying on the bed of the tank, where it stirs up the sediment lying on the bottom. Before being mixed with this mud, the new precipitate, which is very finely divided, will not coagulate, and takes a long time to settle; but when the old precipitate, consisting of coarse particles, is stirred up, the fine particles attach themselves to the coarse ones, which greatly accelerates the subsidence of the precipitate when the water is allowed to rest. After the blower has been in operation for fifteen minutes, the steam is turned off, and in about thirty minutes, or from that to an hour, very nearly all the precipitate will have settled to the bottom of the tank, and the water will not contain more than about one grain per gallon of suspended matter.

In the tests made at the works of Mr. Jackson, the polluted water was from the bleaching process—probably one of the most difficult effluents to deal with. The tests occupied about an hour, from the commencement of the process to the finish, when samples of he water were taken. These, though retaining a rather dark brown colour, were perfectly free from any solid matter in suspension, and of sufficient purity to pass all the conditions required by the Rivers Pollution Commissioners.

The darkness in the colour was due to the quantity of lime introduced being scarcely sufficient; and the process was repeated, with additional lime, when an almost perfectly clear effluent was obtained. This repetition is a special advantage of the process introduced by Messrs. Mather and Platt, as a further purification of the effluent, supposing any mistake to have occurred in the first process, would be absolutely impossible in other systems, as the water would have passed away, and in such an event might possibly result in action on the part of the Commissioners. In this process, the polluted water is not allowed to be discharged from the tank until a sufficiently clear effluent is obtained. The average period for dealing with the water, from the time of receiving it to obtaining a clear effluent, ranges from 1¼ to 1½ hours; while meantime the second tank is being filled with polluted water for treatment simultaneously with the discharge from the first tank.

It may be added, in conclusion, that, in the process for softening water, a plant on the above system has been successfully in operation for some time at the locomotive works of the Midland Railway at Derby, dealing with 30,000 gallons per hour; and that at a mill in Nottingham water is being treated which has 35·5° of hardness, and contains both carbonate and sulphate of lime, as well as a large quantity of magnesium salts. The hardness in this water is reduced to an average of 3·2°; and the formation of boiler scale is entirely prevented.

Dinas Fire-Bricks.—Dinas bricks are now manufactured, according to Herren Seger and Cramer, writing in *Stahl und Eisen* (1895, XV., p. 1084), at Freienwalde-on-Oder. A quartz-like mineral, resembling the Dinas quartz of South Wales, and containing a high percentage of silica, is found in Germany; and this furnishes a suitable material for producing these bricks. The qualities required in the bricks are solidity, high melting-point, and freedom from shrinkage in the fire. The methods by which comparative tests of the English and German bricks were made, are fully described by Herren Seger and Cramer. The German bricks examined fused at about the same temperature (3880° to 3930° Fahr.) as the English ones; but they were superior to the latter in respect of constancy of volume.

The New Factory Act.—The Act of last session to amend and extend the law relating to factories and workshops comes into force to-morrow. It repeals the first paragraph of the schedule to the Notice of Accidents Act, 1894, so far as gas-works are concerned (so that these works will not henceforth come under the provisions of that Act), and the second paragraph, relating to accidents occurring during the construction or repair, by means of a scaffolding, of any building exceeding 30 feet in height, entirely. Under section 18 of the new Act (which is to be substituted for section 31 of the Act of 1878), written notice of an accident is to be forthwith sent to the inspector for the district, if it causes loss of life or such bodily injury as to prevent a workman from being employed for five hours on his ordinary work on any one of the three working days after the occurrence. In the case of fatal accidents, the certifying surgeon of the district is to be notified, unless the accident is of such a nature as to bring it under the Explosives Act, 1875, by section 63 of which notice has to be given to a Government inspector. An inspector may obtain a Magistrate's order to prohibit what he regards as dangerous machinery; and where accident is caused by neglect to fence, enlarged provisions are made with respect to compensation to sufferers thereby.

Obituary.—We regret to record the death, on the 20th inst., at his residence, Fairfield Court, Eastbourne, of Mr. George Ambrose Wallis, Resident Engineer of the Eastbourne Water Company. Deceased was the son of Mr. A. S. Wallis, of Walham Green, Middlesex. After undergoing a course of study in water and sanitary engineering, he was elected, just thirty years ago, as an Associate of the Institution of Civil Engineers; becoming a member in 1877. He was first connected with the Eastbourne Water Company in 1860, when the works were being provided by the late Duke of Devonshire. The population of the town was then about 4000, whereas at the present time it is estimated at 40,000; while the rateable value has risen from £20,000 to £300,000. In bringing about this result, Mr. Wallis was an active participator; for, being appointed Agent to the Duke, and Surveyor to the old Local Board, he was able to suggest and carry out many improvements. One of the greatest works he accomplished, however, was in connection with the new water-works, which were opened in 1883 by the Prince and Princess of Wales. Mr. Wallis had by that time resigned his public appointments, and become Chairman of the Local Board, and Resident Engineer of the Water Company. He was the first Mayor of Eastbourne. Mr. Wallis was in his 56th year at the time of his death, which was the result of only a short illness.——We have just learnt with regret of the death of Mr. Augustine Marie Murphy, formerly the Manager of the Cirencester Gas-Works. Deceased succeeded his father, who undertook the management of the works on the establishment of the Company in 1833; and for a period of about thirty years he directed successfully the practical operations of what has become one of the most prosperous local undertakings. A serious illness a few years ago necessitated the relinquishment of his duties, which passed into the hands of the present Manager (Mr. E. M. Beecham); but his interest in the works continued until his death, which occurred on the 14th inst. during sleep.

REGISTER OF PATENTS.

Producing Metallic Carbides and Illuminating Gas Therefrom.—Ellis, C. B.; a communication from T. L. Willson, of New York No. 16,342; Aug. 27, 1894. No. 16,705; Sept. 1, 1894.

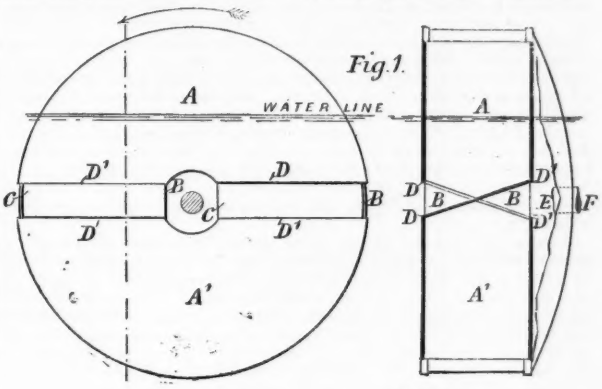
The objects of these inventions have been sufficiently described in the various accounts given in our pages during the past year of the patentee's proposals.

The claims for both inventions are substantially the same—(1) The production of crystalline calcium carbide, by subjecting lime and carbonaceous matter in suitable proportions to the continued heat of an electric arc between a carbon pencil above and a conducting hearth or pool of reduced material beneath. (2) The production of hydrocarbon gas by heating a compound containing calcium with carbonaceous matter in an electric furnace, so as to produce a carbide of the metal or metals contained in such compound, and afterwards, by acting upon the carbide so formed with water, to generate the hydrocarbon gas. (3) The production of acetylene gas by treating calcium oxide with carbonaceous matter in an electric furnace, so as to produce calcium carbide, and afterwards acting upon the calcium carbide with water to produce acetylene.

[The above inventions are those for which application is to be made to Parliament next session for a Private Act to permit the antedating of the patents to Feb. 28, 1894—see *ante*, p. 1151.]

Wet Gas-Meters.—Warner, W. J., of South Shields, and Cowan, W., of Edinburgh. No. 25,257; Dec. 29, 1894.

This invention forms modifications of, or additional improvements in, the form of wet gas-meters described in patents Nos. 1698 and 4504 of 1894; and it has for its object "to still further improve the said class of meters." The claims for the present invention are: (1) In wet gas-meters the construction of an independent abstracting wheel, with abstracting channels or chambers. (2) The employment of an abstracting wheel as an "inner wheel" in communication with alternate chambers of the major wheel. (3) In the "drums," "cylinders," or "wheels" of wet gas-meters, the combination therewith of two segmental chambers or channels, arranged in the form of a wheel, to take the place of an ordinary four-chambered "inner wheel," and placed in



communication with the chambers of the main or "major wheel" and the case (the common outlet), or with the chambers of the "major wheel" and the "hollow cover" (the common inlet) of the wheel.

The most simple combination of the segmental chambers is that of two chambers AA^1, in fig. 1, each rather less than a half cylinder, placed immediately over each other; thus forming a cylinder with spaces B between the two halves. The opposite sides of the cylinder are connected by inclined portions or partitions C, similar to a partition of an ordinary wheel, and the spaces of the rim of the wheel are entirely closed. When driven, as shown by the arrow, the gas will be taken in at the back of the wheel at D, and discharged into the hollow cover E at D^1; and so of the chamber A^1—the gas being taken in at the back of the wheel, delivered into the "hollow cover" E, and thence conveyed back to the inlet-gas by the spout F. The axis of this cylinder is, of course, concentric with the shaft.

As shown in fig. 2, the abstracting wheel may be made by combining the segmental chambers or channels AA^1 across each other, with their axes placed diagonally across the shaft; or rather they would be if each were an entire half cylinder. The form of each chamber may, however, be better described as being a half cylinder, with a portion of each opposite end cut away diagonally, and the sides then being made good so as to form the chambers and the inlets or intakes D and outlets D^1. The chambers AA^1 are separated from each other by the triangular partitions GG^1; the two inlets or intakes D being open to the exterior of this wheel, and the outlets D^1 discharging into the "hollow cover" E, from which the gas is conveyed to the common inlet as described.

As a further modification (fig. 3), the chambers or channels are made in spiral form—that is to say, a cylinder M is employed, within which are firmly soldered two spiral-shaped partitions, in such a manner as to form a wheel with two chambers or channels HH^1, the intake ends CC^1 of which are arranged at the back of the wheel, while the outlet ends FF^1 are open to the "hollow cover" E, as already described.

In this form, the number of abstracting channels or chambers may be more conveniently and neatly varied than in any other. Thus the two chambers are combined so as to form an "inner wheel"—that is to say, the wheel is formed as a cylinder having two spiral-shaped partitions, or it may have four partitions; thus forming (by the two additional partitions, placed intermediately between the other two partitions) an "inner wheel," with four spirally-formed chambers. Further, in the construction of a three-chambered combined wheel, the abstracting channels of the "inner wheel" may be arranged in the same manner—that is to say, as the cylinder with two chambers having the partitions arranged for taking in the gas from alternate chambers, and the variation by alternate forming four chambers, so in like manner a three-chambered wheel may have an abstracting arrangement of three chambers, formed by three partitions arranged at equal distances around the inner side of the cylinder, in like manner to those with two and four chambers.

In thus varying the number of partitions and channels, the arc of each abstracting chamber must be such as to ensure the sealing of each chamber at the "low-water line," and the abstracting and delivering of the compensating volumes, as already described. A "hollow cover" and "spout" are necessary in every case to separate the inlet and outlet gas, though the "hollow cover" may be used either as the inlet or outlet to the ends of the chambers which it covers. If the end of the abstracting wheel opposite to the "hollow cover" be open to the case of the common meter, then the gas will be abstracted through the open end and delivered into the "hollow cover;" the ends of the chambers entering the water as the inlets, and the opposite ends rising from the water as the outlets within the "hollow cover," into which the gas is discharged as the inlet end enters the water. Hence the abstracting wheel may be arranged with its chambers discharging to the left or the right of the shaft looking at the "hollow cover," or with the spirals as a right or left handed screw, as may be most convenient in the arrangement of the ordinary meter and the abstracting wheel. The ends of the chambers entering the water are always the inlets or intakes; the other ends being the outlets or discharge ends. The abstracting wheel may therefore be driven with, or in the opposite direction to, the meter-wheel—abstracting the gas directly from the meter case, and returning the gas so abstracted through the "hollow cover" to the common inlet; or by reversing the motion, the gas may be abstracted through the "hollow cover," and discharged into a case over the abstracting wheel, and thence into the common inlet. The abstraction, however, may be made to take place always through the open end of the wheel or through the "hollow cover," without changing the direction of the motion of the abstracting wheel. Thus C and C^1 are the inlets or intakes, with the motion of the abstracting wheel as shown in fig. 4; if the direction of the motion be changed to the opposite direction, then F F^1 will be the inlets. But by changing the relative position of the inlets and outlets of the two chambers—placing H^1 in the position of H, and *vice-versâ*—the intakes and deliveries will be reversed. The water-line of the abstracting wheel being that of the meter, any variation will equally, in action, affect the two wheels; a volume changing with the varying capacity of the meter wheel being abstracted and returned to the common inlet.

The second part of the invention relates to the constructing of a meter-wheel, with the improved wheel as a new "inner wheel." One form of this application is illustrated in fig. 4; the inlet and outlet gas being in every case separated by the construction of the combined wheel. The "hollow cover" of the abstracting wheel is, of course, removed. The relative positions of the "inner" and major wheel may be arranged as with the combined wheels—that is to say, the gas may be abstracted from the outer case (the common outlet), and delivered into a filling chamber of the major wheel; or it may be abstracted from an emptying chamber, and delivered into the "hollow cover" (the common inlet). Also the gas may be abstracted from an emptying chamber, and delivered into a filling one. In the first case, the abstracting wheel being placed at the back of the combined wheel, the inlets or intakes will be at the back and outside of the major wheel; the outlets or deliveries being just through the rising partition of a filling chamber. In the second case, the abstracting wheel is placed at the front of the combined wheel, and the deliveries take place in the "hollow cover;" the inlets of the abstracting wheel being open to the emptying chambers of the major wheel, the gas is abstracted from them. In the third case, the abstracting or inner wheel is placed entirely within the major wheel; the gas being abstracted from an emptying chamber and delivered into a filling one. The chambers of the abstracting wheel must be soldered perfectly sound to the partitions through which they pass, to below the low-water line; and each chamber of the abstracting wheel must be also perfectly sound, and only in communication with the chambers subject to its action.

Igniting the Charge in Gas-Engines.—Cordingley, I. & T. W., of Trowbridge. No. 25,275; Dec. 29, 1894.

This invention in connection with igniting the combustible charge in gas-engines, consists in forming a baffling-block with ports of certain dimensions, and an inverted thimble operated automatically by the compression in the cylinder. The thimble covers and uncovers (or baffles) the flame travelling from the ignition-tube to the cylinder; so that ignition can only take place at certain required times, and premature explosions are prevented. Instead of the baffle-block and inverted thimble, a quadrant valve may be attached to the cylinder, and caused to open by the piston and close by the air-valve.

Coin-Freed Gas-Meters.—Wright, F., of Old Queen Street, Westminster. No. 1325; Jan. 19, 1895.

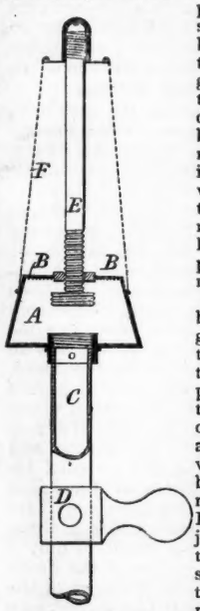
The arrangement of this coin-freed gas-meter was described and illustrated in the JOURNAL for Oct. 22 last (pp. 823, 826). The claim made for the invention being for the use in coin-freed fluid meter apparatus of a wheel or disc geared to the meter counter, and having through it holes to receive coins. On the one side of the disc is a stop-valve for the fluid, closed by weight or a spring; and on the other side is a plunger or pusher in line with the valve-stem, but incapable of moving it. The arrangement is such that, when no coin occupies the hole facing the plunger, the valve-stem is in the hole; the valve being closed. But when a coin is pushed into the hole—extruding the valve-stem—the valve is opened; the disc is allowed to rotate; and the valve is kept open till another hole comes in line with the stem. As a modified arrangement, a reciprocating plate having a hole for the coin is substituted for the rotating wheel or disc.

Incandescent Gas-Mantles.—Taylor, A. and W. S., of Glasgow. No. 1577; Jan. 23, 1895.

This invention in relation to incandescence gas-lighting has for its objects: (1) The production of mantles of greater durability, and at much less cost, than those at present in use; and (2) to provide a burner of the Bunsen type, arranged to supply gas and air for heating the mantle to incandescence, and yet adapted to be used as an ordinary gas-jet in the event of the mantle being injured or removed.

The mantle is made from "a knitted, woven, or other meshed or open fabric of cotton, linen, or other fibre," shaped to the usual conical or tapered tubular form, or of hollow globular or other shape; the fabric being treated by immersion in, or coating with, reagents containing bromine, chromium, uranium, and calcium, and serving as a support therefor—the fabric being consumed by burning in the usual way, while the salt or earthy matter remains and becomes incandescent by the combustion of the gas within the mantle.

Under one modification, the mantle fabric is dipped in a weak solution of hydro-bromic acid, 40 per cent.; ammonium bichromate, 40 per cent.; uranium acetate, 10 per cent.; and potash alum, 10 per cent. Thereafter it is immersed in a strong solution of calcium carbonate, or of calcium carbonate and magnesium carbonate, in the proportion of about 60 per cent. of the former salt to 40 per cent. of the latter. The top and bottom parts of the mantle may be further treated by immersion in, or coating with, manganous oxide and manganic hydrate in admixture. After drying, the mantle may be rendered flexible, and preserved against breakage, by immersion in, or coating with, "any suitable medium as ordinarily practised." After burning off the preserving medium, and with it the vegetable or other fibre remaining in the mantle, the residue upon which the burning gas acts to raise it to incandescence is largely composed of lime and other inexpensive ingredients. Phosphoric acid, acetic acid, or ammonium chloride may be substituted for hydrobromine acid.



The patentees propose to employ a special burner of the form illustrated; having the usual gas and air mixing chamber A, with perforated top B for the passage of the mixed gas and air, to produce a non-luminous flame of high temperature; the mixing chamber being attached to the end of a gas-supply pipe C, formed with orifices for the admission of air, but fitted with a gas-tight sleeve D for cutting off the air supply when desired. Through the top of the chamber A is screwed a tube E, which serves as the means for supporting the mantle F over the Bunsen flame, and in which is fitted a flat-flame jet burner covered by a cap. The lower end of the tube E is adapted to fit a corresponding screw-thread on the gas-supply pipe C entering the chamber A, or (as shown) this screw-thread may be formed in the lower end of the chamber. When the mantle F is in use with the Bunsen flame, the flat-flame burner tube is screwed up out of the gas-supply pipe, so that gas and air freely enter the mixing chamber; but in the event of the mantle being damaged or removed, this tube is screwed down to fit in or on the gas-supply pipe E. The air-inlet orifices in the gas-supply pipe are thus closed by the sleeve; and the gas passes without admixture with air through to the flat-flame, so as to afford an ordinary luminous flame.

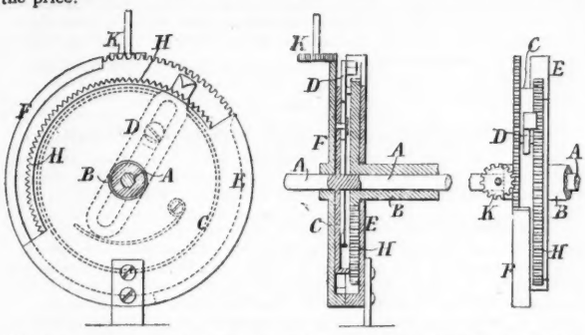
Refractory Bodies for Use in Incandescent Burners.—Kroll, O., of Berlin. No. 2732; Feb. 7, 1895.

In order to overcome the disadvantages usually manifested in incandescent mantles as ordinarily manufactured—rapid deterioration after a short time resulting from the shrinking and scaling of the incandescent body—the patentee proposes to employ zircon and magnesia in the mantle in extremely thin layers. The effect of this, it is claimed, is to form a mantle of very fine porous framework, which, by its rough fibrous surface, "is able to send forth more rays of light than any of the commonly-known smooth bodies."

The chemical compounds employed are: 20 per cent. of chlorate of potash (KCl); 40 per cent. nitrate of baryta (BaO, NO_5); and 40 per cent. carbonate of baryta (BaO, CO_2). These materials are brought into solution by means of nitric or muriatic acid, and then evaporated to dryness. The residue is exposed for days together to an extreme white heat (all air being throughout excluded), and is then ready for use for the impregnation of any woven material selected for the framework of the mantle. Small quantities of the rare earths usually employed for incandescent mantles may, if desired, be added to the above-named mixture.

Adjusting Gear for Coin-Freed Meters.—Wright, F., of Old Queen Street, Westminster. No. 3266; Feb. 14, 1895.

This invention relates to gearing of coin-freed meters, by which the quantity of gas supplied for a coin can be adjusted to suit variations in the price.



A is a spindle worked by the meter—as, for instance, the spindle of the first index of the counter. B is a sleeve loose on the spindle, and connected by worm or other gear to the coin-freed mechanism (which may be of any kind). C is a disc fixed on the spindle, and having an arm D fitted to slide radially on it, and urged outwards by a spring. The outer end of the arm D is thickened, and has one side shaped as a tooth. E is a disc, loose on the sleeve B, but fixed on the framing of the meter. F is another disc, which, by means of a pinion K gearing with a toothed part of its circumference, can be partly turned around the spindle, and can be held in any desired position. Both the discs E and F have at their peripheries inwardly projecting flanges, cut away for half the circumference. H is a toothed wheel fixed on the sleeve B.

The operation of the apparatus is as follows: As the counter-spindle A revolves, it carries round the disc C and arm D, the tooth of which, being held engaged with the teeth of the wheel H by the flange of the disc E or F, causes the sleeve B to revolve, and drive the coin-freed mechanism. But when, after revolving a certain distance, the end of D escapes from under the flange of E or F, its tooth becomes disengaged from H, and A goes on revolving without driving B, until the end of D again passes under the flange of E or F, which causes its tooth to engage again with, and drive the wheel H. Thus every revolution of the spindle A causes a less or greater fraction of a revolution of the sleeve B, according as the disc F is set with a greater or less interval between its flange and the flange of E. Consequently the coin-freed mechanism driven by B requires a greater or less number of revolutions of A, and therefore the passage of a greater or less quantity of fluid, to receive the movement necessary to give effect to the action of the introduced coin.

As an example of the application of the apparatus to a coin-freed gas-meter, the patentee assumes that every revolution of A registers a passage of 2 cubic feet; that the wheel H has 120 teeth; and that the sleeve B has to make 10 revolutions for the passing of one penny through the coin-freed mechanism. If the disc F be s t so that the end of its flange coincides with the end of the flange o. E, then the tooth is held engaged with the wheel H during the whole revolution of A. Consequently the penny will purchase 20 cubic feet—the product of 10 revolutions of A by the 2 cubic feet delivered at each revolution. If now the disc F be turned round relatively to E, so that there is between the ends of their flanges a gap uncovering 60 of the teeth of H, then, as the tooth is during half a revolution of A disengaged from H, it will require 20 revolutions of A to cause 10 revolutions of B; and consequently the penny will purchase 40 cubic feet. By turning F to intermediate positions, various quantities, between the minimum of 20 and the maximum of 40 cubic feet, can be delivered for a penny.

Sun-Burner Gas-Lamps.—Thomas, W. J., of Denmark Hill, Camberwell. No. 9914; May 20, 1895.

This invention relates to enamelled metallic cones, domes, gas-burners, and deflectors for use in connection with non-regenerative gas-lamps of the sun-burner type, whereby the light "is greatly increased, ventilation is procured, and the products of the gas are disposed of, combined with either heated or cold air inlets."

According to one part of these improvements, the burners are arranged externally in and around a closed receiver or chamber (as described in patent No. 5102 of 1888). Inside the closed receiver under the cones or pyramids inverted, which form a separate chamber at the lower part of the receiver, is placed, at a suitable distance, a dome or cone (with its apex upwards), supported by a small rod or stud fixed into the screw-plug in the bottom portion of the receiver. This dome or cone, which can be made of metal, steatite, or asbestos, has the advantage that any particle of dust or carbon that may pass through into the receiver, and through the cone or pyramid, cannot return, as the cone with its apex upwards causes the dust or carbon to descend into the bottom of the receiver, and forms an additional baffler or guard against the deposits blowing into the burner orifices.

The burner used consists of a long hollow tube of steatite or soapstone, pierced as usual with gas-orifices cased in a steel or metal casing screwed externally at one end, and combined with a shield or deflector of angular shape, placed at the underside of the jet, so as to project higher than the steatite jet, and cause the flame to spread out and prevent cold air currents striking against it.

Incandescent Gas-Burners for Indoor and Outdoor Use.—Deimel, F., of Berlin. No. 16,642; Sept. 5, 1895.

These improvements have for their object "not only the production of a full and uniform heating flame approximating as nearly as possible to the shape of the incandescence mantle, but also the protection of the flame against gusts of wind and the like, and the protection of the mantle itself, with increased lateral and direct supply of air."

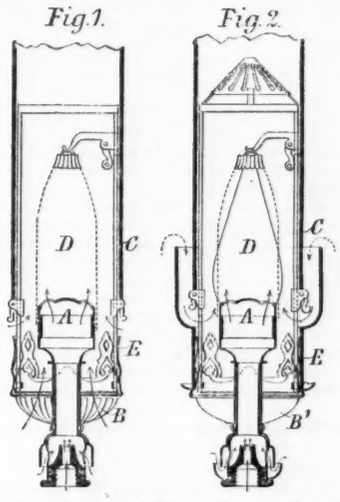


Fig. 1 shows the arrangement for use in closed spaces; and fig. 2 the same burner arranged for the open air.

The burner-head A is closed by a domed plate, which in its peripheral domed part is formed with slits which, "for effecting a gentle flowing together of the laminæ of gaseous mixture issuing therefrom," are either formed as "successive epicycloidal curves," or they may have a straight oblique form. The gaseous mixture receives by this means, in combination with the domed form, an "outward directed upward" motion, so as to form a full flame approximating as nearly as possible to the form of the mantle (as indicated at fig. 2) accompanied by a short rotary motion, independently of the fact that by the peripheral curvature, the outlet-orifices are substantially increased in size without enlarging the diameter of the burner-head.

For protecting the flame against one-sided increased air-currents, and for preventing the flame from striking back into the air-admission holes of the mixing chamber, there is provided a downward extending shield, the lower edge of which, in the burners used in the open air (fig. 2), is surrounded by an inverted shield. The air must, in this case, first pass over the upper edge of the lower shield, and then from the latter under the shield and through the openings into the mixing chamber.

With the burner as at fig. 1, the air for combustion passing to the mantle enters from below through the burner-cage B into the lamp-glass C, and also laterally direct to the mantle D, as indicated by the arrows. If the flame is to be protected against disturbing air-currents from below, as in street-lamps, there is employed in place of the burner-cage with openings shown at B (fig. 1), a closed burner-cage B^1 (fig. 2); and the air supply to the mantle D is effected solely by the raising of the chimney-glass C. This raising of the chimney is effected by a device which is either inserted in the burner-gallery E, or it can be fixed to the burner-cage B^1. The device consists of vertical rods connected together at the top and bottom by rings, and inserted into the burner-gallery. A cap having openings protects the mantle D against objects that may fall into the glass; while the supports in combination with the top ring prevent the possibility of the mantle being damaged on fitting on the glass.

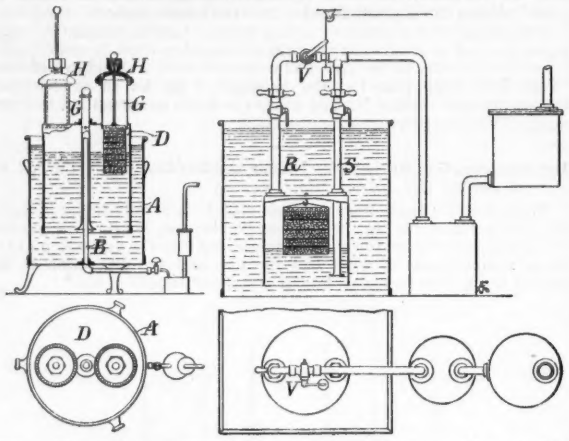
The supports carry adjustable clamps, fixed by means of their eccentric levers, and serving as the support for the glass. One of the supports can be fitted with an adjustable carrier for the mantle, which allows not only of the use of the raising device for burners of different heights, but also enables it to be raised or lowered relatively to the burner-head.

As by the raising of the glass C, for the lateral and direct admission of air to the mantle D, an opening is formed which leaves the lower part of the mantle unprotected, it is necessary to guard against lateral gusts of wind by means of a cylindrical shield made of transparent material, which surrounds the lower edge of the chimney-glass in such a manner that the external air can only enter the cylinder C from above on its way to the mantle, as shown by the arrows in fig. 2.

Acetylene Gas Generating Lamp.—Kaestner, C., of Halle-on-Saale, Germany. No. 18,824; Oct. 8, 1895.

Two forms of the "automatic gas-generating acetylene lamp" are shown in the engravings—fig. 1, a partial sectional view of a single lamp; and fig. 2, a gas-generator (with holder) for use on a large scale.

Upon the vessel A is mounted another vessel B; and from the latter water flows (through a bent pipe D, in which is a cock N and a non-return valve) on to a layer of felt E. Under the felt is a plate F, provided with a funnel-shaped extension, forming an outlet G. The opening in G is of a size to correspond with the consumption of gas by the



lamp, and in such a manner that only a single drop can form at this place. The felt is therefore provided for the purpose of straining the water, and thereby preventing the aperture in the funnel G from becoming stopped up by dust, &c. The apparatus is connected to a gas-holder J (fig. 2) for the purpose of supplying a large number of burners. But in this case it is advisable to provide two generators, in order that gas may be formed continuously. The conduit from the generator to the holder may either be shut off by a cock M, or back flow of the gas may be prevented by means of a non-return valve P. The receptacle for the calcium carbide is provided at its lowest point with a screw cap or plug for cleaning, &c. When the water comes in contact with the calcium, the acetylene gas formed rises through the pipes H; and when the cock C is open, it flows into the burner K, which is formed with extremely fine holes, in order to prevent the flame smoking.

Gas-Lamps for Theatres, Public Buildings, &c.—Tollerton, J., of Leeds. No. 20,208; Oct. 26, 1895.

The patentee proposes a special construction of "sunlight gas-lamps, so as to increase their ventilating power, as well as their lighting power." The usual clusters of ring burners are employed, with reflectors above them, so arranged as to leave an air-space between any two reflectors, in order to provide an uninterrupted exit of vitiated air and products of combustion at the central outlet. The tops of the reflecting chambers are also perforated, with the same object.

Gas and like Engines, and a Method of Mixing and Volatilizing the Gases used.—Kane, T., of Chicago, U.S.A. No. 20,305; Oct. 28, 1895.

This invention relates specially to that class of engines in which hydrocarbon oils are used for the purpose of enriching a certain amount of air to make an explosive mixture. The object of the invention is to provide such an engine, adapted "to vaporize the hydrocarbon liquid, perfect the mixture of the gases and air, and the volatilization of the explosive mixture within the cylinder, so as to cool the cylinder after each explosion of the mixed vapour and air, thus increasing the efficiency of the engine and economy of construction."

APPLICATIONS FOR LETTERS PATENT.

24,068.—Sturgess, G. F., "Gas-burners and a method of igniting the Bunsen burner." Dec. 16.

24,073.—Robertson, J. C., and Wallace, J. A., "Illuminant to be used in connection with gas and kerosene lamps and candles and the like." Dec. 16.

24,088.—Synnock, W., and Gosling, G., "Production and automatic distribution of acetylene gas." Dec. 16.

24,097.—Herring, W. R., and Graham, M., "Charging inclined retorts." Dec. 16.

24,113.—Pulling, A. R., and Rivolta, F. J., "Freeing and maintaining such freedom of water from pipes during frosty weather, or shutting off the flow during repairs to pipes." Dec. 16.

24,133.—Beechey, C. G., "Coin freed or actuated gas-meters and analogous apparatus." Dec. 17.

24,171.—Darby, J. H., "Manufacture of ammonium salts." Dec. 17.

24,196.—Pym, E. B., and Gore, J., "Manufacture of acetylene gas." Dec. 17.

24,207.—Neumann, A., "Igniting devices for gas-jets, and manufacturing the same." Dec. 17.

24,383.—Cutler, S., "Gas liquor separators." Dec. 19.

24,384.—Cutler, S., "Oil atomizer for gas carburettors." Dec. 19.

24,437.—The Anglo-Swedish Trading Association, Limited., and Wollert, O. E., "Electrical and other gas lighters and extinguishers." Dec. 20.

24,463.—Riordan, T. V., "Mediums for igniting coal gas, and in the application of such mediums to gas-burners." Dec. 20.

24,464.—Schulz, F. L., "Gas-lamp wherein several incandescent gas-burners are united." Dec. 20.

24,485.—Haydon, G., Urry, F. H., and Sommerville, G., "Coin-reed gas (and the like) meters." Dec. 21.

24,505.—Taylor, A., "Mantles for incandescence gas lighting." Partly communicated by W. S. Taylor. Dec. 21.

24,527.—Lamplough, F., and The Automatic Heat Regulator Company, Limited., "Atmospheric burners automatically controlled." Dec. 21.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Prices of Ammoniacal Liquor and Sulphate of Ammonia.

Sir,—Allow me to thank you for your courteous reference in this week's Journal to my complaints and criticism of your "Current Sales of Gas Products" reports. I am sorry to find that my speculations are thereby confirmed—that your aim is to quote the prices at which time-contracts are or could be made. Although most of the liquor sales are, as you state, made over a period, yet I still venture to hold the opinion that, had you found it possible to give weekly a fairly accurate standard of the week's actual deliveries, your reports would have afforded a more useful guide to local gas authorities. The difficulties in the way, you clearly indicate.

Average prices having prevailed in the past, your records of contract levels have answered satisfactorily as a measure of weekly deliveries. But present prices being extreme, if not abnormal, speculative contract standards misrepresent the values of the week's deliveries of liquor.

I cannot but admit that your position is unassailable. Recognizing the prevailing custom, you cannot be expected to record values measured by another and a different scale. However keen my disappointment at your inability to accept my suggestion, my thanks are nevertheless due for your clear and explicit statements, since they cannot fail to make evident the justice of my appeals for modifications of the existing contracts, previously alluded to, and which were made on the assumption that your quotations were based on the actual values of the weekly deliveries of liquor.

H. C. Brown, Ph.D., F.I.C.

King's Lynn, Dec. 27, 1895.

The Relative Prices of Crude Naphtha and Benzols.

Sir,—I have read Mr. Simon's letter in your Journal of the 17th inst.; and as I believe I am the oldest tar distiller now living (having commenced business in 1851), might I suggest the following to your readers.

Since Perkins discovered mauve in 1856, and the discovery of other aniline colours which followed soon after, I have had very considerable experience in the refining of crude naphthas—being one of the first makers of benzol commercially, at which time it was sold at 21s. per gallon. I have also dealt in them largely both as a buyer and seller, as they are collected from the tar-stills, both for spot deliveries and by contracts running over a given period; and I have always found that crude yielding 30 per cent. distillate at a temperature of 120° C. is not a test in itself of the value, or the estimate of the quantity of benzol it contains. Buyers invariably test the samples by practical methods, based on experience, to ascertain in the first place the loss by treatment with rectified sulphuric acid and caustic soda and water washings, which varies much in different samples—say, from 12 to 20 per cent. By fractional distillation, benzol, toluol, solvent and heavy naphthas are separated, leaving creosote in the still.

I think if Mr. Simon will go farther into the question, he will find the benzol much less than he anticipated. It is quite true that 90 per cent. benzol has advanced to the price named. But we must not overlook the fact that solvent and heavy naphthas, and also creosote, have not increased in value; and these form a considerable bulk of the crude. It will, therefore, be seen at once that Mr. Simon's argument does not hold good.

The apparent low price of 30 per cent. crude naphtha may, to some extent, depend upon the quantity under contract previous to the rise in benzols. But as these contracts run out, I think sellers will have a good chance of getting better prices, so soon as refiners are again in the market to renew.

Joseph Turner.

Great Yarmouth, Dec. 24, 1895.

P.S.—It must also be borne in mind that there are several makes of crude naphtha which show 30 per cent. at 120° C., but actually contain very little 90 per cent. benzol; so that the increase in value on this is really very trifling.—J. T.

The Extensions at the Plymouth Gas-Works.

Sir,—I am loth to occupy your columns with personal matters; but I cannot allow the letter from Mr. West, in your last issue, to pass unchallenged. He impugns the accuracy of my figures, and puts forward others to support his contention. I abide by my statement in its entirety. Anyone who chooses can test my figures by referring to the balance-sheets of the Plymouth Gas Company for the years ending March 31, 1890 and 1895, respectively. They will be found absolutely correct.

H. Townsend.

Wakefield, Dec. 26, 1895.

[By a clerical error, the amount of the deficit on sulphate at the end of Mr. West's letter appearing last week was given as £12,000 instead of £1200.—Ed. J. G. L.]

Explosions of Domestic Boilers.

Sir,—I have read the correspondence in the Journal on the subject of the circular letter recently issued by the Board of Trade to water companies in regard to domestic boiler explosions. In the absence of legislative enactment, I assume that any recommendation to owners of such boilers can only take the form of a suggestion; and if that should have the effect of saving men, women, and children from the danger and suffering caused by these explosions, why should not the suggestion be made?

In response to the Board of Trade letter, I have issued, in the district of the Water Company of which I am Secretary, a public notice, and sent one to each person who is known to have such a boiler in use. I thought it a right thing to apprise persons who are often oblivious of the danger to which they are exposed, and to suggest the best known means of prevention.

I enclose a copy of the notice above alluded to, which you are at liberty to make any use of that you think proper.

Deal Water-Works, Dec. 27, 1895. W. R. HAMMOND.

[ENCLOSURE.]

The Board of Trade having called the attention of the Deal Water-Works Company to the large number of explosions which have occurred, during periods of severe frost, from boilers used for domestic purposes, and the Board being advised that most of these casualties might be avoided by the adoption of simple precautions to prevent the freezing of the water in the pipes, or to relieve any excess of pressure which may arise in the event of the water becoming frozen, and having requested the Water Company before the approach of winter to make their customers and the ratepayers acquainted with the precautions that should be taken, I have been in communication with Lavington E. Fletcher, Esq., the Engineer-in-Chief of the Manchester Steam Users' Association, with the result that the following suggestions are now made :—

1.—In the case of low-pressure circulating boilers, a small safety-valve should be fixed to the boiler to relieve the pressure that may arise therein in case of stoppage in the pipe.
2.—In the case of high-pressure circulating boilers, there is a difficulty in applying safety-valves; and there is no way of securing these boilers against explosion but that of keeping up the fire, and keeping not only the boiler but the entire range of pipes hot, so as to maintain the circulation throughout as long as the frost lasts.
3.—If the fire has to be lighted during frosty weather, it should be carefully ascertained whether the temperature steadily rises throughout the entire range of pipes; if not, circulation is impeded, in consequence of which pressure may accumulate, and explosion ensue.

The Water Company desire to impress upon their customers and the ratepayers the necessity of adopting precautionary measures to minimize, as far as possible, the serious consequences that may arise from the recurrence of boiler explosion.

[Our readers will see, by a paragraph which appears in another column, that the Grand Junction Water Company have also issued some suggestions on this matter to their customers.—ED. J. G. L.]

LEGAL INTELLIGENCE.

Alleged Frauds upon the Bristol Gas Company.

The Magistrates at the Bristol Police Court were engaged for several hours yesterday week in investigating a case in which Henry Harris, a well-known ironmonger and gas-fitter, of Bristol, was charged with having stolen, from the Bristol Gas Company, 5000 cubic feet of gas on June 13 to 18, 1887, and 500 cubic feet on June 10 and 11 last. The prosecution was represented by Mr. F. Weatherly, and the defendant by Mr. C. Salter. Before opening the case, Mr. Weatherly applied that the date in the second charge might be altered to June 17, as the person who laid the information fixed the date from memory, and had made a mistake. This was not really a fresh case, as what the Company were going to allege was a continuous taking of gas. It was agreed that the case should proceed, and that Mr. Salter should reserve his right to ask for an adjournment if he should think fit to do so. In laying his case before the Court, Mr. Weatherly stated that Mr. Harris was a respectable citizen, and a successful man of business. The Company only obtained the information upon which they proceeded in November last; and, after taking precautions not to launch a prosecution hastily against a respectable citizen, they felt it their duty to bring the case before the Bench, and ask them to consider whether the prisoner should not be committed to take his trial before a jury. Mr. Harris used his own gas-meter, which was fixed in a cellar under his shop. A man named Gummer, who was discharged from his employ in June of the present year, having been apprenticed to him in 1886 for five years, informed them that about the winter of 1887 he saw another apprentice, named Cooper (who had since died) making what he described as a composition pipe with brass unions; and on the day on which the contrivance was made, it was fixed on the meter inlet and outlet pipes. From that day until he was discharged, Gummer constantly had occasion to go into the cellar, and saw the fraudulent connection upon the meter, and also (which was very significant) some sacking put upon it. Three other witnesses, all of whom had been in Harris's employ, would testify to having seen the connection. There were 12 gas-jets in the workshop, 12 elsewhere, and 24 outside the shop—48 in all; and since 1885, there had been a considerable drop in the amount of gas paid for by Harris. Evidence confirming Counsel's statement was given by Mr. J. Phillips, the Secretary of the Gas Company, and by William Gummer, Charles Harris, Arthur Sutton, and Henry Crinks, gas-fitters and plumbers, who had been in Harris's employ. The case was adjourned until to-day; the defendant being admitted to bail in his own recognizances in the sum of £300.

The Costs in the Dublin Litigation.—Another scene in the litigation between the Dublin Corporation and the Alliance Gas Company was recently enacted before the Master of the Rolls; application being made by Mr. C. O'Connor, on behalf of the Corporation, for permission to appeal against an order of the Taxing Master certifying the costs to be paid by them, amounting to £1670. The items specially objected to related to the fees of expert witnesses and the special fees for the preparation of the briefs. The Solicitor-General opposed the application; pointing out that the Taxing Master had already reduced the solicitors' charges in respect of the latter matter. He contended that it was too late now to raise the question; and the Court declined to accede to the application. Referring to this subject on the 22nd inst., the Dublin *Sunday World* remarked that in the estimate for next year only £1777 is provided for; and evidently no account has been taken of the costs of the Corporation—probably £1000 more—nor of those for both sides in another action with the Company in which the Corporation were defeated. These total up to a further sum of £1000, or nearly 1d. in the pound kept out of sight of confiding ratepayers.

MISCELLANEOUS NEWS.

ELECTRIC LIGHTING NOTES.

The electric lighting scheme of the Swansea County Council has developed into a triple one—viz., electric lighting, refuse destruction, and tramway working by electricity. This comprehensive project, which, it is believed, will place Swansea in the proud position of being "one of the foremost towns of the country," has been explained to the County Council by Alderman Martin. The report, which we have before us, however, gives no account of his statement respecting the main branch of the scheme and the refuse destruction. In connection with the tramway scheme, the Council are proposing to incur some financial responsibility. They intend to expend £10,400 in paying off debentures which were in the hands of the Tramway Company; and they will also have to advance £21,600 to enable the Company to provide motor cars. By doing this, the Council will obtain a good customer for power during the daytime. The terms for a supply, which have been practically agreed upon with the Company, are: For a minimum consumption of 400,000 units per annum, they are to be charged at the rate of 2d. per unit, decreasing to 1⅞d. and 1¾d. for a minimum consumption respectively of 600,000 and 700,000 units. As an engine will have to be running during the day, the Company can (so says Alderman Martin) be supplied with power without extra charge. If they take 400,000 units, this will represent a revenue of £3333, which, it is expected, will cover all the station charges and everything but interest and sinking fund; and, consequently, they will be able "to sell electricity, at a profit, to the ratepayers and business men at a price which gas could not touch"—in fact, the price at which the Council seem to confidently reckon to supply current is not at present touched by any town in the kingdom. Some of the worthy councillors must have listened to this statement with open-mouthed wonderment; and no doubt, at the close of the meeting, they heartily congratulated each other on the fact that it had been left to them to be the pioneers of cheap electric supply. Following up what took place at the meeting, Alderman Martin moved the adoption of the minutes of the Committee who have the matter in hand; but Mr. Davies wished for the consideration of the question to be deferred until the Committee brought up complete estimates of the entire scheme. He moved an amendment to this effect, which was seconded by Alderman Leeder, who saw in the rapid adoption of incandescent gas-lights by shopkeepers a barrier to the anticipated success of electric lighting. Several members had something to say upon the subject; but there was no particular point in their observations. The amendment was defeated; and the minutes were confirmed. Nothing further, however, will be done in regard to the scheme until a public meeting has been held.

Electric current was first supplied from the Bolton Corporation electricity works in the autumn of 1894, since which time the undertaking has undergone a continuous process of development. Recently there has been added to the plant a direct-driven alternator and a compound vertical engine; and the Committee have under consideration the erection of further similar machinery to prepare for the 1896 season. Special plant is also being laid down at the station by which a constant twenty-four hours' service will be maintained, without increasing the staff. At present, there is a cessation in the supply from midnight to six in the morning. It is interesting to note that there are now nearly 8500 lamps on the mains; being an increase since the opening day of about 6000 lamps. The capacity of the existing plant at the generating station is 6500 lights, but never more than 65 per cent. of the 8500 lamps now connected are alight simultaneously.

At the last monthly meeting of the Preston Town Council, a discussion took place in regard to a proposal on the part of the Town Hall Committee to light the Public Hall and Town Hall by electricity, at an estimated cost of £2024. Mr. Copeland, in moving the adoption of the Committee's minutes, said the Preston Electric Lighting Company had offered to supply the light at 4½d. per unit. Mr. Hall, who opposed the scheme, argued that the figures of the Committee were formed on a wrong basis, and that practically the Council were asked to spend £61 to meet a gas bill of £78 per annum. There was, in his opinion, something radically wrong in the figures as to the candle power of the gas-lights at the Public Hall and the Town Hall; and if the Council spent £2024 over the electric light, they would have absolutely 4983-candle power less than there was at present. Gas at 3½d. per 100 cubic feet was equal to 360 candles; whereas electricity at 4½d. per unit would give only 288 candles. The electric light might be good enough for those who could afford it; but the £2024 would be better employed if it were devoted to essential things, and not to buying luxuries. Mr. Healey contended that, apart from the cost of installation, the electric light would be as cheap as, or even cheaper than gas, besides being a better illuminant. Alderman Edelston said the installation of the new light seemed to be terribly expensive; at any rate, the sum was too large to be voted at once. Mr. Thompson had a strong opinion that the Corporation should have electricity works of their own; but he had to confess that the terms offered by the Electric Lighting Company dispelled his views on that point. Alderman Davies said that to spend about £2000 when they had gas-fittings in the halls named, without any information as to improved gas lighting, would be a mistake. The Corporation book showed that the consumption of gas in the Town Hall was 4571 cubic feet an hour—or equal to 3·60 candles per burner per hour, which would give the estimated number of candles at 16,455, as compared with 9142 candles as stated by the Committee. When the Committee proposed to put in 11,474 candles as a substitute for the present lighting, it meant giving that number of candles against 16,455, and not against 9142 as suggested. This practically meant providing less light. As to the cost, the Electric Lighting Company, by their own showing, admitted electricity to be 60 per cent. dearer than gas. He reminded the Council that the Preston Gas Company, with the exception of the Railway Companies, were the largest ratepayers in the town, being rated at £10,334. Other speakers followed, and ultimately the matter was referred back to the Committee for further consideration—the voting being 21 to 9.

Saltash is disappointed. A month ago, it was dazzled by the prospect of an immediate installation of the electric light, and the illumination of its ancient streets in a manner at once brilliant and cheap. As already recorded (*ante*, p. 1097), the Corporation accepted a tender for lighting the street-lamps by electricity at the sum of £2 10s. per lamp. Difficulties have, however, arisen with reference to the contract. A local paper, characterizing the proceedings of the local authorities as "most extraordinary," says the tender of an undischarged bankrupt was first accepted; but when the contract was produced for signature, it was found to have been drawn up in the name of his wife. Again and again efforts were made to secure the acceptance of the tender. But the difficulties were insurmountable; and at last it was wisely decided to allow the matter to drop. The only course now open to the Council is to accept the tender of the Gas Company, and continue the present system of lighting.

In another little Cornish town, the electric lighting prospects are more encouraging. Mevagissey, which has just adopted the Lighting Act, is going in for the electric light. A Company has been formed, with a capital of £1100, the shares have all been taken up, and arrangements are being made for the installation of the light. Among the customers will be the Harbour Trustees.

The poll of the ratepayers of Fareham on the question of purchasing the undertaking of the Fareham Electric Lighting Company, or the paying of the damages (£3800) awarded in the recent law-suit for non-fulfilment of contract, took place last Saturday week. The poll was taken on the new list, on which there are rather more than 1400 names; but of these not one-half availed themselves of the ballot. The result was that 431 were in favour of the purchase of the works, and 235 preferred the payment of the damages—giving a majority of 196 in support of the former course.

Another fatality in connection with electric lighting has to be recorded this week; Herr Sommer, the Chief Engineer of the municipal electric lighting works at Frankfort, having been killed by a discharge of electric current of the strength of about 3000 volts.

DARLINGTON GAS, ELECTRICITY, AND WATER SUPPLY.

Strong Opposition to the Improvement Bill.

The Statutory Meeting of ratepayers of Darlington for the purpose of discussing the Bill which is being promoted by the Town Council was held yesterday week, and was largely attended. The various provisions of the Bill, covering a number of schemes of improvement, were explained by the Mayor (Mr. J. J. Wilkes). Part 4, he stated, related to the gas supply. It was proposed to acquire certain land to the north-east of the present gas-works for extensions, and also for the erection of an electric lighting station, which was a matter for future consideration. In Part 5, which referred to the water supply, scarcely any of the clauses could be obtained without an Act of Parliament. The proposals were generally for the better management of the works, and a better supply of the commodity which they had to sell to the inhabitants of the town. It was proposed by Part 7 to extend the time during which they could exercise powers with regard to the supply of the electric light. Alluding to the question of rates, his Worship mentioned that, at the end of December, repayments in connection with the gas and water undertakings would be reduced equal to 5¾d. in the pound; but owing to the way in which the books were made up, this would not come into the revenue until 1897-8. At the end of 1896, an amount would be paid off in connection with the gas and water works and the covered market equal to slightly more than 10½d. in the pound; and this would come into effect at the beginning of 1898. This made a total of nearly 1s. 5d., which was a very handsome amount; and the only thing they could regret was that it did not come into operation a little earlier. In the Bill, it was proposed to take powers to borrow £50,000 on water-works account, £50,000 on gas-works account, and £30,000 for electric lighting. With respect to the first two amounts, he only wished they were twice as much, because they were two great trading departments of the Corporation, and whatever profit they made went into the municipal coffers, and assisted in the reduction of the rates. The clauses of the Bill were freely criticized; the speakers in support having a hostile reception at the hands of a certain section. A motion to adjourn the meeting was proposed amidst much clamour; and eventually the Mayor declared it adjourned for a week.

It seems from an article in the *Northern Echo* that the opponents at the meeting created quite a bear-garden scene; and they have been deservedly reproved, in severe terms, by our contemporary. Dealing with the necessity for additional plant at the gas-works, the *Echo* says that there is an impression that the expenditure under this head is only asked for in order to be able to supply the proposed extended area of the borough—*i.e.*, of Blackwell, Haughton-le-Skerne, and Cockerton. This is not so. If no extension of the borough takes place, the new plant will still be needed, or the operations of the Gas Committee be seriously crippled. "Gas making," it is pointed out, "is one of the paying businesses of the Corporation. And it may be noted by those who possibly never thought it over before that the whole of the money which has been spent on the gas-works—all the thousands of pounds of redemption and interest—has come, not out of the pockets of the ratepayers, but out of the pockets of the gas consumers; and more still, that the Gas Committee out of their profits have handed over to the Finance Committee towards lessening the rates of the town an average of £2000 a year. We submit that to interfere to check this source of revenue is suicidal. Water, again, is one of the necessities of life and another of the commodities which the Corporation vends; and to restrict its hand when told that an extension of borrowing power is absolutely required for assuring us an efficient water supply, is even more to be deprecated than interference in the case of gas. As regards electric lighting, if a profit is to be made by introducing it, by all means let that profit flow into the treasury of the town, and not into the pockets of a few capitalists. We say the men who are in opposition to these clauses of the Bill, or to those clauses which deal with town and sanitary improvements, are as short-sighted in their generation as the opponents of railways in theirs, and are doing their best to belittle the intelligence of the town and mar its progress."

THE POSITION OF THE BRITISH WATER-GAS INDUSTRY.

The Ordinary General Meeting of the Amalgamated Water-Gas Companies, Limited, is to be held to-day, at the Great Northern Hotel, Leeds. The report of the Directors to be presented on the occasion gives an interesting account of the progress of the undertaking, as will be found from the following extracts:—

The Company was incorporated on Sept. 27, 1893, with the object (*inter alia*) of taking over as going concerns and amalgamating the undertakings of the British Water-Gas Syndicate, Limited, the North British Water-Gas Syndicate, Limited, and the Yorkshire and Lancashire Water-Gas Company, Limited. It took over the whole of their assets and liabilities. To meet these liabilities and the expenses of liquidation of the Vendor Companies, it had chiefly to rely upon the amount to be produced by the instalment of 10s. per share due from the shareholders of the North British and of the Yorkshire Companies, both of which were largely in debt to the British Syndicate. It was understood that the shareholders of all the Vendor Companies would be relieved of any further demand in respect of the remaining liability on the shares. The Directors of each of the Vendor Companies nominated a Director of the Amalgamated Company, in accordance with the Articles of Association; it being understood that at the first general meeting all the Directors would retire, and the shareholders be invited to appoint Directors of their own choice. The Directors nominated were Mr. T. Procter, Mr. Samson Fox, and Mr. J. Mitchell, who then asked Mr. F. G. Worth to join the Board, and to act as Managing-Director. To this he consented, on the understanding that he would retire with the other Directors. Mr. Mitchell, who was a staunch believer in water gas, and erected plant for incandescent lighting both at Mitchell Main Colliery and at his private residence, died in April last.

The Vendor Companies in November and December, 1893, passed resolutions for voluntary winding up. Notice was at once given to the respective Liquidators by the Board of the Amalgamated Company that they were ready to allot the fully-paid shares to which the shareholders in the Vendor Companies were by agreement entitled—viz., 199,993 fully-paid shares of £1 each. Seven shares were allotted to the subscribers to the Memorandum and Articles of Association, making up the total to 200,000. Unfortunately, a few shareholders in the North British Syndicate had combined to oppose the amalgamation of the Vendor Companies; and the legal proceedings taken by dissentients caused the Liquidators of those Companies to delay carrying out the contract.

The statutory meeting of the Amalgamated Company was held on Dec. 22, 1893, and an ordinary general meeting on Dec. 29, 1894, to comply with the requirements of the Companies' Acts; the only members on the register being the subscribers to the Memorandum and Articles of Association and the Directors. The Directors were advised that they must continue to hold office until their successors were appointed by the full body of the shareholders, after the completion of allotment. It is only lately that it has been possible to complete the allotment and the issue of certificates to the shareholders of the Vendor Companies entitled to participate in the distribution.

The Directors, from the date of formation of the Company, have been unceasing in their efforts to get the contract completed; and it is solely litigation which has stood in the way. The few dissentients have caused the expenditure of thousands of pounds. Had they been successful in their action, the balance of the instalments due on the shares of the Vendor Companies could have been called up. Under the circumstances, it has been an extremely difficult and arduous task for the Directors, and especially for the Managing-Director, to provide for the liabilities of the Vendor Companies. But this has now been accomplished, after the actions brought by the dissentients had been dismissed with costs. The possibility of a further call being made upon the shareholders, in respect of their holdings in the Vendor Companies, is thus averted. But litigation has entailed an enormous waste of time and money which would otherwise have been available for business purposes, and has thrown back, since the beginning of 1893, the interests of the general body.

The business of the Company has been almost at a standstill, as, even when the actions in the High Court were disposed of, there were threats of fresh proceedings from the same quarters; and the Liquidators, under advice, felt unable to carry out the provisions of the contract without first obtaining the sanction of the Court at various stages—thus further delaying matters.

To facilitate the operations of the Company, the Directors of all the Vendor Companies agreed to waive the bulk of the fees to which they were entitled; and, with one exception, none of them have since been paid. The owner of the Uddingston property (Mr. James Reid Stewart), in lieu of insisting on payment of the purchase price of £15,000, overdue to him from the British Syndicate, agreed to allow that liability to be transferred to the Company, and further agreed that, conditionally on interest being paid, he would not ask for payment of the principal for a period of five years. None of the Directors are taking fees; and for some time past, the Managing-Director has relinquished his claim to salary, and has continued his services to the Company as a Director without remuneration. The Uddingston revenue account showed in 1894 a profit of nearly £900; but the past year has unfortunately resulted in a loss.

With regard to the financial position of the Company, the amount brought from the profit and loss account in the balance-sheet (£9110) includes some liabilities of the Vendor Companies. The sum of £6564 12s. 8d., shown in the balance-sheet as due to certain creditors, includes the estimated cost of liquidation of the three Vendor Companies and a provision for law costs. It also includes £2500 outstanding balance of claim of the Directors of the North British Syndicate, for fees for which they waived payment by the Liquidator, in order that the money might be used for reducing the liabilities taken over by the Company. Several of the liabilities have, however, been met since the date to which the balance-sheet is made up (Sept. 30).

Had the contract entered into with the Vendor Companies been carried out without opposition, the cash balance, after paying all liabilities, should have left sufficient funds to enable the Company to

complete the contract at Messrs. Spencer's plant, and, on showing the further successful application of water gas in different directions, to lay the foundation of a profitable undertaking. It must, however, unfortunately be assumed that, consequent upon the opposition, there will be practically no working capital left.

The question then arises whether there are still sufficient prospects of a successful issue to the undertaking to warrant further investment. The Directors believe such prospects exist in the patents already owned by the Company. Beyond this, they hope to be able to acquire several recent improvements in the use of water gas as an illuminant. They hope, further, that they may be able to secure for the Company an option of acquiring an interest in a new discovery, cognate to the business of the Company, which it is expected will prove of considerable commercial value. The Directors were not at the date of the report (Dec. 21) in a position to make a more definite statement in relation to these matters; but they anticipated being able to do so at the extraordinary general meeting to be held after the ordinary meeting to-day to decide the question of further capital.

THE GAS SUPPLY OF BROOKLYN AND MONTREAL.

Consolidation of the Brooklyn Gas Companies.

The Brooklyn *Eagle* for the 24th ult. contained the following remarks on the subject of the recent consolidation of the Gas Companies supplying that city:—

The consolidation of all the Brooklyn Gas Companies is at last an accomplished fact. The majority of the stockholders in the old Companies have exchanged their securities for the new; and there has been quite a lot of trading in them. There does not seem to be anything now which can prevent the new Company from carrying out the ideas which have been in the minds of some of the largest capitalists for the last dozen years—that is, the manufacture of gas for Brooklyn under the management of one Company, with all the accompanying economies. There is no need for going over ancient history in local matters. The majority of people remember the gas war of about twelve years back, when what is known in business circles as the Standard Oil crowd, with the Fulton Municipal Company, raided the territory of every other Company in the city until they cried for mercy, and secured it by contributions of peace offerings substantial in character. It is also recalled that, after the war was over, gas securities regained their proper value; and the same crowd which had caused their depreciation, and bought them when low, sold them out; and the profit of their venture in Brooklyn has been variously estimated at from one to two millions of dollars. Judging from the present rate at which the securities of the new Gas Company are advancing, the remembrance of former profits will be wiped out by the magnitude of the sum which will be made out of this deal.

It will be remembered, by people familiar with gas matters in this city, that on Sept. 1, 1894, the Beckton Construction Company, which was the vehicle by means of which J. Edward Addicks tried to bring about a consolidation of gas interests in this city, sold out one-half of its holdings in several of the Brooklyn Companies. There were 1185 shares of Metropolitan, 20,016 of Brooklyn, 3994 of Citizens', 375 of Fulton Municipal, and 125 of People's. The lump sum paid for these securities was given out as being $785,000. The cheque which was paid over, if the statements which were made at the time are correct, was drawn by Mr. H. H. Rogers, who has managed about all the gas deals in which the Standard Oil people have been interested as individuals. Anyone who is nimble with a pencil can figure out the market value of the securities of the new Company which this crowd has received for those stocks alone. Taking the bonds at 107 and the stock at 84, it totals up to the tidy sum of $1,835,300. The difference between the price paid and the present market value is $1,050,000. No one for a moment supposes that the stocks which were secured from the Beckton Company were all that the crowd held. It is well known that they were in the market during a large part of last fall, and all the winter and this spring; and it was generally conceded that the majority of the stock in every one of the Companies, with the exception of the Nassau and the Williamsburgh, was controlled by the same people. It is, therefore, probably quite accurate (as a man pretty well posted in gas matters said) that, even at present prices, their profits are between three and four millions. The prospects of their securing even greater returns are excellent, for there seems a very good chance of the stock moving higher than it is at present.

The way that people are figuring on the proposition is somewhat after this fashion: The output of all the Companies last year for which pay was received was 3500 million cubic feet. The profit made by a Company like the Williamsburgh, Nassau, or Fulton Municipal, who have works of the best kind and a large output, is nearly 50 c. per 1000 cubic feet, which gives net earnings of $1,750,000. The fixed charges on the $15,000,000 of bonds which the new Company have issued is $750,000; and the net income therefore is, according to that method of figuring, $1,000,000.

Others go even further, and say that, taking the output last year at 3500 million cubic feet, it should be larger this year by 10 per cent., because of natural growth, and because there is now no reason why the new Company should not canvass actively for business. Heretofore it has been the custom of each of the Companies not to do any canvassing, for fear of starting up a little gas war. It should also be possible to secure payment for a great deal more gas, because a delinquent customer now has no alternative but to pay up or go without gas. The operating expenses and cost of manufacture should also be less, because of the economies secured by consolidation. They take the margin of profit at only 40 c. per 1000 cubic feet, and figure out the same results—that there will be $1,000,000 to be divided into dividends.

On the other hand, it is a source of mystery to the conservative investor how Companies which heretofore paid out in dividends and fixed charges about $750,000 can by consolidation do more than twice as well. The explanation given of this by the people who think that Brooklyn union gas is a good thing is that the Companies did earn very nearly that amount, but that they were all afraid to make public their earnings for fear of inducing a raid from some other Company, or a strike by the legislators at Albany; and each one felt the necessity of saving its strength for a day when trouble might arrive. In addition to this, they say that the new Company has several hundred thousand dollars worth of real estate to sell as soon as there is a good market for it.

The New Gas Contract for Montreal.

The following are some of the points in the agreement lately entered into between the authorities of Montreal and the Montreal Gas Company for the supply of gas in that city for the next ten years: The Company are to furnish all the gas-lamps and the gas therefor that the city may require during the existence of the contract for lighting the streets, lanes, and public places of the city, at the rate of $17 per lamp per annum, and on the same conditions as in the previous contract. The Company bind themselves to supply and furnish gas for lighting, heating, cooking, and manufacturing purposes within the limits of the city during a period of ten years, to be computed from the 1st day of May last (1895), such gas to be coal gas made from Canadian or bituminous coal, with a small proportion of coal oil for illuminating purposes, and of an illuminating power of not less than 21 sperm candles, at a price which shall not exceed $1·20 per 1000 cubic feet, generally furnished and supplied by the Company for lighting purposes during the above-named period, and of $1 per 1000 cubic feet generally furnished and supplied during that period by the Company for cooking, heating, and manufacturing purposes, on prompt payment. Nevertheless, in order to facilitate the use of gas to the poorer class of people, the Company are to be bound to furnish gas for cooking purposes, with the privilege of two gas-meters for lighting purposes, at $1·05 per 1000 cubic feet, furnished and supplied by means of automatic regulator burners to all the taxpayers of the city paying a rent not exceeding $150 a year. During the existence of the contract, the said authority are not to permit the laying of gas-pipes in the streets and lanes of the city. The city are to have the right to provide for the inspection of the gas and meters furnished by the Company, and to this end to appoint an inspector, who shall also have the power of regulating the pressure of the gas, and shall for that purpose have free access at all times to the works of the Company.

METROPOLIS WATER SUPPLY.

The Quality of the Water in November.

The returns furnished to the Registrar-General by the London Water Companies regarding the water supply in the Metropolis during November, show that the average daily supply amounted to 203,454,828 gallons, as compared with 189,709,339 gallons in the corresponding month of 1894. The number of services being 823,457, the rate was 247 gallons to each service. Of the entire bulk of water sent out, 106,376,477 gallons were drawn from the Thames, and 97,078,351 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·6; Tottenham, 1·2; East London (deep well), 1·5; Colne Valley, 1·7; New River, 2·7; Chelsea, 3·7; East London (river supply), 4·3; Grand Junction, 5·3; West Middlesex, 5·9; Lambeth, 6·8; and Southwark, 6·9. The unfiltered river waters contained the following proportions: Thames at Hampton, 10·4; New River Cut, 4·2; Lea at Angel Road, 6·6. The Thames at Hampton was, on Nov. 18, very turbid and brown in colour. It was of very bad chemical and bacterial quality. As delivered by the five Companies, however, drawing from this river, the water was in every case efficiently filtered, and, with two exceptions, of most excellent bacterial quality. By reason of large storage capacity, by which flood water had been avoided, the Chelsea Company were also enabled to deliver water of good chemical quality. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 99·93; West Middlesex, 99·96; Southwark, (No. 4 filter well) 99·81, (No. 8 filter well) 98·93; Grand Junction, (general filter well at Hampton) 98·37, (general filter well at Kew Bridge) 99·89, (south filter well at Kew Bridge) 99·91; and Lambeth, 99·97. The New River Cut, before entering the subsidence and storage reservoirs, was, on Nov. 20, turbid and yellow in colour. It was of fairly good chemical, but inferior bacterial quality. By passing through the storage reservoirs, the number of bacteria in a given volume was reduced to nearly one-fourth; and, after efficient filtration, this water was delivered to consumers in excellent chemical and bacterial condition for dietetic purposes. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 99·45; No. 4 filter well, 99·45; No. 6 filter well, 99·9. The water taken from the Lea by the East London Company at Angel Road on Nov. 20 was turbid and pale brown in colour, and of inferior quality both chemically and bacterially, although it was in both these respects much better than the Thames at Hampton. After storage for 15 days, more or less, the number of bacteria per cubic centimetre was reduced to less than one-half; and, after efficient filtration, this water was delivered to consumers in good chemical and excellent bacterial quality—the bacterial improvement being represented by the following percentage numbers: No. 1 Essex well, 99·32; No. 2 Essex well, 99·80; and West Middlesex well, 99·60. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes, and the supplies of the Kent and Colne Valley Companies were perfectly clear and bright without filtration; but that of the Tottenham Local Board of Health was slightly turbid, and that of the East London Company very slightly turbid. The Colne Valley Company's water had been softened before delivery, and was thus rendered suitable for

washing. Seen through a stratum 2 feet deep, the Kent and Colne Valley waters were clear and colourless; the Tottenham, slightly turbid and colourless; the East London (deep well), very slightly turbid and colourless; the New River, clear and very pale yellow; the Chelsea and East London (river supply), clear and pale yellow; the West Middlesex and Grand Junction, yellow and clear; and the Southwark and Lambeth, deep yellow and clear. The bacterioscopic examination of the raw river waters before and after storage, and of the supplies delivered by the various Companies, and collected on Nov. 18, 19, and 20, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw and Stored River Waters.		
Thames at Hampton, Nov. 18	29,260	8·6
Thames, after storage for 14·7 days (Chelsea Company), Nov. 18	500	9·0
Thames, after storage for 6 days (Lambeth Company), Nov. 18	13,140	8·9
West Middlesex Company's water (passing on to filters 1–5), Nov. 19	2,900	8·3
Grand Junction Company's water at Kew, passing on to filters 3, 4, 5, 6, and 7, Nov. 19	840	8·9
Grand Junction Company's water arriving at Kew from Hampton, Nov. 19	1,160	9·0
New River Cut, before passing through reservoirs, Nov. 20	5,800	7·3
New River Cut, after passing through reservoirs, before filtration, Nov. 20	1,520	8·2
River Lea at Angel Road (East London Company), Nov. 20	10,040	7·6
River Lea, after storage for 16 days (East London Company), Nov. 20	4,080	8·2
Filtered River Water as Supplied.		
Thames—		
Chelsea Company's general filter well, Nov. 18	20	9·6
West Middlesex Company's general filter well, Nov. 19	12	8·2
Southwark Company's No. 4 filter well, Nov. 18	56	8·7
Southwark Company's No. 8 filter well, Nov. 18	312	9·2
Grand Junction Company's general filter well at Hampton, Nov. 18	476	8·5
Grand Junction Company's general filter well at Kew Bridge, Nov. 19	32	8·8
Grand Junction Company's south filter well at Kew Bridge, Nov. 19	28	9·0
Lambeth Company's general filter well, Nov. 18	8	9·0
Lea—		
New River Company's general filter well, Nov. 20	32	8·1
New River Company's No. 4 filter well, Nov. 20	32	7·6
New River Company's No. 6 filter well, Nov. 20	5	8·2
East London Company's No. 1 Essex well, Nov. 20	68	7·9
East London Company's No. 2 Essex well, Nov. 20	20	8·0
East London Company's Middlesex well, Nov. 20	40	7·6
Deep-Well Waters.		
Kent Company's new well at Deptford, Nov. 19	4	11·3

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied in London during November, as ascertained by tests of samples taken daily on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 182 samples examined, three were recorded as clear but dull; the remainder being clear, bright, and well filtered. We have to record a large excess of rainfall in November; the quantity measured at Oxford being 4·17 inches, as compared with 2·31 inches (the average for 25 years)—showing an excess of 1·86 inches. The rain was chiefly confined to the first half of the month; three-fourths falling during the first fifteen days. There were thirteen days on which no rain fell. It is satisfactory to be able to report that the Thames-derived waters show a marked improvement in quality when the analyses for the past month are compared with the results for the corresponding period of last year. The autumnal floods invariably cause a slight increase of colour; and the organic carbon is correspondingly raised. Our bacteriological examinations give the following numbers of colonies per cubic centimetre:—

Thames water, unfiltered	7400
Do. from the clear-water wells of the five Thames-derived supplies—	
Highest	120
Lowest	44
Mean	88
New River water, unfiltered	5000
Do. from the Company's clear-water well	70
River Lea water, unfiltered	2000
Do. from the East London Company's clear-water well	52

These results show a very high efficiency in the methods of filtration employed by the Water Companies, and that the quality of the supply is excellent.

The Lighting of Seaton.—Dissatisfaction is felt at Seaton, Devon, with the manner in which the local gas supply is managed. A fortnight ago the gas failed, and the town was in darkness. The local paper which refers to the incident says nothing as to the cause, but alludes to it as "another" failure of the gas supply, and urges the ratepayers to consider the advisability of taking over the gas-works.

NEW YORK WATER SUPPLY.

Auxiliary Reservoirs and the New Croton Aqueduct.

The present water supply for New York City is derived, as most of our readers are aware, from the storage and delivery of rain falling in the Croton Valley, which has a watershed extending north-easterly about 34 miles from the southern extremity of Manhattan Island to about 61 miles from it, and having an average width of about 11 miles, and a total area of about 362 square miles. Of this area, about 360 square miles is available for supply. The old Croton Dam across the Croton River had a length of 270 feet and a height of 50 feet, and an impounding capacity of 2000 million gallons. It supplied the city through the old brick and stone subterranean aqueduct, which delivered as much as 96 million gallons a day. This supply becoming insufficient, it was determined, in 1883, to construct an additional conduit, and to increase the impounding and storage works so as to provide for a much larger delivery of water in dry seasons, and to allow for the probable increased consumption due to the city's growth. The second conduit, built of masonry mostly in tunnel, with a cross-sectional area of 156 square feet, a length of 163,003 feet, and a calculated capacity for a maximum delivery of 318 million gallons per diem, was called, for distinction, the "New Croton Aqueduct." It was completed in July, 1890, and was soon delivering all the available additional supply of some 35 million gallons a day, which made a total of about 131 million gallons a day. This supply was found inadequate for the uses and wastage of a city which then had about 1,515,000 inhabitants, and in many houses in the higher districts of which the pressure varied 30 or 40 feet daily between the hours of the greatest and the least draft. To provide against the then imminent water famine, the construction of auxiliary storage works was, and has been since, vigorously prosecuted. These, when completed, are expected to provide for the requirements of the next 20 years, and store and deliver a maximum quantity of 2800 million gallons a day, even through excessively dry years. The need for them is demonstrated by the present condition of the water supply of the city, as shown by the paragraph which appeared a short time ago in the JOURNAL. This provision is to be effected by the great $4,000,000 dam now across the lower part of the Croton River itself, which was begun in 1893, and is expected to be finished in 1900, with a height of 245 feet over the lowest foundations, a total length of about 1800 feet, and a storage capacity of about 32,000 million gallons, and also by the completion of the system of auxiliary dams and reservoirs on the other principal streams of the watershed which are tributary to the Croton River, and which will have a combined storage capacity of about 15,000 million gallons. The principal reservoirs are at Sodom, Carmel, Amawalk, Purdy's, and Brewster's. They all are completed, or nearly so. The one at Purdy's impounds the Titicus River, to form a reservoir having a capacity of 7200 million gallons and a maximum depth of 121 feet. The work was designed by the Chief Engineer (Mr. A. Fteley, M.Am.Soc.C.E.). The contract for the dam was let for about $1,000,000. The work presented many interesting features of design and construction, which have lately been described and illustrated in the *Engineering Record*. The contract involved, in round numbers, about 566,000 yards of earth excavation, 38,800 yards of rock excavation, 425,000 yards of earth embankment (included in the 566,000 yards of earth excavation), 2000 yards of concrete, 113,000 yards of rubble, and 8050 yards of dimension and cut stone. Besides these quantities, the actual classification included 18,000 square feet of face work for rubblestone masonry, 8200 square feet of fine hammered (six-cut) face dressing, 10,000 square feet of rough-pointed face dressing, 600 cubic yards of brick masonry, 15 cubic yards of brick masonry laid in asphaltum mortar, 3000 cubic yards of riprap laid, 8000 cubic yards of broken stone laid, 11,400 cubic yards of dry masonry and paving, 600,000 feet of permanent timber placed and fastened, 10,000 superficial square yards of sodding, 73 tons of cast-iron hub and spigot straight pipe, 144 tons of special castings, 20 tons of wrought iron, two 48-inch stopcocks, and 640 lineal feet of ornamental iron fence. All sodded or seeded surfaces are covered with soil at least 6 inches in thickness. The embankments for the dam all start from a well-prepared base, stepped on sloping ground, and are carried up in horizontal layers not exceeding 6 inches in thickness. They were kept at an approximately uniform height on both sides of the masonry during construction. Dry rubble masonry and paving laid without mortar were used for walls, for the slopes of the dam embankments, and at some other places.

Reference has already been made to the new Croton aqueduct; and it may be of interest to append some particulars in regard to it. It was designed to carry from the Croton dam to New York City the additional water supply procured by the development of the storage system in the Croton Valley. Its diameter of 14 feet is proportioned to the rest of the supply system. Tunnelling was adopted on account of the high value of the ground along the line; and the location was separated from that of the old surface aqueduct between the same terminals so as not to encounter the probably disintegrated rock near the foot of the hills. It deviates from a straight line only for the purpose of intersecting a few transverse valleys, so as to secure an opportunity to empty its contents through them. For the first 25 miles, the aqueduct has a descent of 0·7 inch per mile; and the water flows through it as in an open channel. The next seven miles it is depressed, and acts under pressure like a pipe at a maximum depth of more than 100 feet in many places, and 320 feet at the crossing under the Harlem River. The rock encountered was mostly gneiss, and in two or three places limestone. The invert of the inlet at the Croton dam was made 140 feet above tide-level, so as to permit of easy emptying at different points on the line. The circular cross-section originally designed was changed to a horseshoe-shaped form (with extreme height and width of 14·53 and 13·6 feet respectively) of equivalent area, which facilitates excavation and masonry work and general convenience, and permits laying the invert when the rest of the work is done. The section of the upper part of the aqueduct is uniform, except where a short inverted syphon of circular area 14 ft. 3 in. diameter crosses

under a swamp. For seven miles under pressure, the aqueduct has a uniform circular section 12 ft. 3 in. diameter, except under the Harlem River, where the diameter is reduced to 10 ft. 6 in., in order to increase the velocity of flow, and diminish the deposition of silt. Of its total length of 163,003 feet, 125,164 feet of the aqueduct has a horseshoe-shaped section, 1135 feet is a 14 ft. 3 in. circle, 34,780 feet is a 12 ft. 3 in. circle, and 1300 feet is a 10 ft. 6 in. circle—all inside dimensions; the thickness and form of brick rings and backing varying to correspond with the pressure and character of the excavation. Near shaft No. 30, where the elevation of the ground is much below hydraulic grade and the rock dangerously disintegrated, the aqueduct was lined with cast iron, to increase its strength and water-tightness. Of the entire length, 29·75 miles were built in tunnel, 34,954 feet of which were supported by timbering; and 1·12 miles were built in open trench. There are eight lines of 48-inch iron pipe, having a total length of 71,170 feet.

At the Harlem River crossing, the 12 ft. 3 in. circular aqueduct approaches on an incline a shaft (No. 25), the bottom of which was excavated to the level of the intended invert of the river tunnel. The indications of test drift, however, determined the changing of the tunnel to a considerably lower grade; and the shaft was continued parallel to the upper section, and with an offset of about 20 feet—forming a convenient landing in the approach tunnel. From the foot of this shaft, the river tunnel was excavated through solid rock at a depth of nearly 300 feet below the surface of the river, and at atmospheric pressure. The New York shaft is No. 25 of the aqueduct line, and extends nearly 20 feet below the bottom of the tunnel to form a sump into which the syphon drains. The aqueduct tunnel on this side connects with the shaft at a level about 140 feet above the connection with shaft No. 24, and permits the construction of a blow-off to the river from the shaft below the level of its invert. Shaft No. 25 is double, consisting of two parallel 12 ft. 3 in. cylinders, one of which is for the aqueduct service, and the other, having a sump, contains a pair of alternating 1390-gallon bailing buckets operated by a steam-engine for emptying the syphon, which has been twice successfully accomplished in a few hours. The aqueduct and bailing-shafts are connected near the bottom by a 1 ft. 8 in. by 2 ft. 6 in. door, commanded by a solid composition metal gate moving in grooves, and operated by a stem 3½ inches square, which is journalled every 12 inches, and set in a 3-feet iron pipe with a ladder. The aqueduct shaft, up to a point 60 feet below high-water mark in the river, and the bailing-shaft and shaft No. 24, are lined with cast iron, and sealed by double manholes at or near their tops. A 20-inch blow-off pipe is laid on the tunnel invert from the top of the incline to the bottom of shaft No. 24, up which it passes through the masonry filling between the cast-iron lining and the rock excavation. It leaves the shaft at a point about 3·61 feet below high water, and is laid in a timbered and bricked tunnel that terminates in a vault, which contains two 36-inch and one 20-inch gates, a branch-pipe for the city service, and a small drainage gate. Beyond this vault the pipe emerges with a diameter of 36 inches in the Harlem River. A clean-out handhole is located in the pipe near the bottom of the shaft. The head of the pipe at the top of the incline is embedded in the invert masonry, which is fitted with stop-plank grooves. The pipe is intended both for use for emptying and for a feed to the service-mains. Each chamber of shaft No. 25 has, about 5 feet above the river, connection with a 48-inch blow-off pipe with two gates. At the adjacent shaft (No. 26), an overflow has been provided with stop-planks; and the surplus water will be discharged thence into the river through a 48-inch pipe. The features and the scale of this syphon are very unusual in water-works construction; and, on account of the excessive pressure, great care and a full knowledge of the structure and its appurtenances are required for opening the shafts. An open stand-pipe extending above the hydraulic grade is connected to shaft No. 25, to prevent danger of a vacuum.

The inlet of the aqueduct at Croton Lake is contained in a massive masonry structure, and consists of a submerged 14-feet circular opening protected by a timber drop-gate, accessible through a shaft, and available for emergency. A brick-lined 14-feet tunnel 624 feet long connects the inlet and main gate-house with all the machinery for regulating the flow of water—including the connections for the new Croton dam and the old and new Croton aqueduct; requiring in all 38 large gates ultimately. Thorough drainage of the gate-house is facilitated by a bailing-pump worked by a turbine. Heavy stop-planks, mechanically controlled, additionally command the various inlets; and any one chamber may be emptied while all the others remain full.

The structures auxiliary to the aqueduct comprise, besides the above described gate-house and river crossing, three blow-off gate-houses, each containing four gate openings and machinery. One gateway in each house is fitted with a temporary timber bulkhead until the large drop-gate is provided to close the whole section of the aqueduct. The gates now in place have a great width, to permit of very rapid emptying of the aqueduct. The terminal gate-house in New York City receives the ends of the old and new aqueducts, and delivers their waters through iron pipes (eight of 48 inches diameter for the latter) to the Central Park reservoir and to the city mains directly. These pipes and their connections are controlled by 26 gates, which enable either aqueduct to be connected with its own pipes or those of the other system. The gate-house at the Central Park reservoir forms the outlet of the four 48-inch pipes in which the new aqueduct virtually terminates. There were 42 shafts excavated for the construction of the aqueduct. A number of them are left open, and connect with head-houses, containing hoisting apparatus; others are closed by cast-iron covers with manholes. Some have been filled up; and a few that are under pressure have an iron lining in the upper part, and are closed below the hydraulic grade by double manholes secured with gibs and keys. Several shafts are entirely lined with iron. Experiments have shown a maximum flow of 300 million gallons in 24 hours through the aqueduct; and at one time water was wasted through the blow-off gates at the rate of 240 million gallons in 24 hours.

The principal construction quantities are in cubic yards: Tunnel excavation, 1,351,995; earth excavation, 333,000; rock excavation, 240,000; brick masonry, 323,000; rubble masonry, 528,000; concrete, 45,000; and cut stone outside of superstructures, 8200. There were 24,000 tons of 48-inch cast-iron pipe. The elevations of the aqueduct inverts are 140 feet at Croton gate-house, and 123·24 feet at the beginning of the first incline. The high-water line at the Central Park reservoir is 119·16 feet. The maximum pressure in the aqueduct when full is 55 lbs. per square inch. The cost per lineal foot varied from $90·99 to $123·25; and it was $14·24 for a single line of 48-inch pipe.

The construction of the aqueduct for some seven miles under pressure is a bold innovation in municipal hydraulics. The masonry used is porous; and the rock encountered was known to be full of fissures. Hence percolation from the inside of the aqueduct was obviously anticipated under the pressure heads that rose to more than 100 feet. Experiments were made to determine what coating on the interior brick surface would best diminish or prevent it; and a light wash of portland cement applied with whitewash brushes was adopted throughout the pressure sections, and found satisfactory. Experiments on the treated surface indicated that a total percolation of a million gallons in 24 hours could have been expected in the pressure tunnel. But subsequent gauging showed it to be only 228,500 gallons; while 4,000,000 gallons percolated into the tunnel from the outside in its upper 25 miles of high-level section.

Owing to the deep subterranean location of much of the aqueduct work, the cramped positions occupied by the workmen, the impure air they breathed, &c., the tendency to slight work was increased; and the presence of large empty spaces shielded by transverse walls clearly indicated the disposition of the contractors, while the restricted powers of the engineers and their exacting technical duties precluded their exercise of a controlling or continuous supervision of the construction. Much difficulty was necessarily experienced in securing enough satisfactory inspectors, as many as 222 of whom were required at one time; and bad work was done at many points of the tunnel, where it was wholly concealed by the brickwork lining and excavation walls. From the beginning of the masonry work, the engineers had difficulty in enforcing the requirements of the contracts, and in securing the dismissal of improper foremen, &c. The time allowed for construction was originally 33 months. It was extended to 40 months; and the 29¾ miles of aqueduct was put in service 66½ months after the beginning of construction.

The preliminary calculations of estimated flow gave 318 million gallons in 24 hours; but the measured volume was subsequently found to be nearly 300 million gallons maximum. Series of observations were taken under different conditions of depth by a special meter inserted at a manhole, and arranged to record the velocity at numerous fixed points covering the whole cross-section of the flowing stream. A weir was also established at the Croton dam; and the upper nine miles of the aqueduct was used as a measuring chamber. But the results were found to be less accurate than those of the meters. The total cost up to Jan. 1, 1895, was $19,759,574.

Dinner to the Employees of the Hexham Gas Company.—The Hexham Gas Company entertained their employees to dinner on Christmas Eve, at the Company's offices. Mr. Herbert Lees, the Secretary and Manager, occupied the chair; and the vice-chair was filled by Mr. John A. Young (the foreman). After dinner, a toast list, interspersed with songs, &c., was gone through; and a most enjoyable evening was spent. Mr. H. Schofield proposed "The Chairman and Directors of the Company" in an appreciative speech. A feeling of goodwill between employers and employed was strengthened by this event.

The Condition of the Margate Water-Works.—Referring to the article on "The Finances of the Margate Corporation Water Department" which appeared in the JOURNAL for the 10th inst., our local correspondent says: "The subject of the borough water supply, and the revenue derived therefrom, continues to excite a considerable amount of attention at Margate. The resolution of the Town Council to adopt Mr. Mansergh's recommendation to thoroughly survey the available sources of supply, at a cost of about £300, has accentuated the interest, and in some cases aroused feelings of uneasiness; it being felt to be certain that the town will have to face the expenditure of a large sum in extending and improving the existing arrangements. When the matter was under discussion at the recent special meeting of the Town Council, Alderman Wootton stated that ever since the undertaking had belonged to the Corporation, it had been worked at an annual loss. The subsidies in some years had been as much as £2000, the total amount of subsidies paid out of the local funds up to the present being £7829 for ten years' working. When it is remembered that ten years ago the Water Company, with a capital of £22,000, worked the undertaking at a profit, the figures supplied by Alderman Wootton (and presented to the ratepayers for the first time by him) are indeed eloquent, and should serve as a wholesome warning to those local authorities who are agitating for the acquisition of water undertakings. At Margate, the Water Department has been slaughtered for the benefit of the Drainage Department; and so far has this policy been carried out, that the Borough Engineer (Mr. A. Latham) has been unable to get the machinery and plant maintained in a proper condition. Indeed, to such an extent has this policy predominated, that Messrs. Thornwill and Warham, the makers of the pumping-engines at the Dane works, having been requested to examine them in consequence of a breakdown, felt it incumbent upon them to draw attention to the mismanagement, and to report that the engines had not received 'constant and skilled attention.' They added that the cause of the bad condition of the plant was due to the engineer-in-charge having other duties which necessitated his absence at times from the station, and of its being left in charge of incompetent persons. As is usual in such cases, no one knows where the blame should be put for the development of such a serious state of affairs. The Engineer claims, and no doubt rightly, that he is not responsible, as his reports and requests have not been acted upon; while the Water Committee are necessarily an irresponsible and constantly-changing body. It is certain, however, that whoever may be responsible for the neglect of valuable machinery and the starving of the labour-sheet, it is the outcome of a line of policy often pursued in respect of municipalized works, but never in connection with efficiently managed undertakings where the directors regard their duties as a matter of business and public requirement, and not as a question of 'trimming' opinions to catch votes at election time."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Of the year 1895, what shall I write? Generally speaking, it has not been an eventful year for the gas industry. There have been no new discoveries of consequence in the processes or appliances for the manufacture of gas; the labour world has been quiescent, even almost to docility, in all except the engineering trade; prices for nearly all commodities have been moderate, in some instances altogether cheap; and, taken all round, the business passing has been fairly good. Out of these conditions, one would naturally spell prosperity; and I daresay that, unless in the case of anyone who may have been specially circumstanced, there are few who will dispute that the year has been one of increased business, if not of greatly increased profits. The cost of coal—which is the principal factor in determining the price of gas—has not receded from the contract prices of 1894, but rather otherwise; although, as a matter of fact, the staple commodity has been procured at less cost than was the case during the Scotch miners' strike of that year. The price of gas is generally lower than it was then; and the rates obtained for residuals—particularly in the later months—have been disappointingly low. These all affect profits; and it is highly probable that, were balance-sheets made up dealing with the twelve month of 1895, it would be found that in most instances, though the volume of business was very sensibly larger, the amount of surplus revenue was not in proportion. These are, however, but passing features of trade; the increased outputs may be regarded as permanent, and are to be hailed with satisfaction as giving the opportunity for realizing better returns in future periods.

The year opened with the announcement of the result of the Falkirk gas arbitration. The price fixed was a high one, and somewhat staggered the purchasers. But it must be said of them that they soon came to realize that it was neither a ruinous nor an unjust price; and they have since shown their capacity for successfully conducting a gas undertaking by the extensive improvements they have introduced. They have, when labour and materials were cheap, remodelled their principal works. They have also introduced the Peebles process for enrichment, and Hislop's regenerative system of firing, by which they are now able not only to produce gas at less cost, but also to dispense with the smaller of their two works, which is now advertised for sale. Since then there have been several proposals by corporations to acquire the local gas undertakings. The Town Council of Dunfermline have adopted the Burghs Gas Supply Act, and confirmed its adoption; but objection to the step has been made by 20 ratepayers, and a plebiscite is to be taken to settle the question. The Police Commissioners of Millport have adopted the Act; it has been talked of in Largs and Brechin; and a proposal for a transfer of the local Gas Company to the Corporation of Stirling is at present under the consideration of a Committee.

The Town Council of Rothesay have resolved, on account of want of room, to remove their works to a new site which they have secured on favourable terms; and they are about to proceed with the actual work. The removal of the Perth Gas-Works has, for the same reason, become desirable, if not necessary; and the proposal has been seriously entertained, and is likely to be heard of soon again.

Extensions have been carried out at Hamilton, where gas of 24-candle power is being sold at as low a price as 2s. 1d. per 1000 cubic feet; and also at Forfar. At Edinburgh, an important installation of stoking machinery on the Arrol-Foulis system has been introduced at a cost of £6470; and the retort-house has been re-roofed at a cost of £3400. In connection with the Edinburgh works, the chimney, which was the tallest gas-works chimney in the world—being 329 feet high—has been condemned, and is now standing a useless pile; having been superseded by a temporary chimney, which will do duty till the new one is completed.

Of new gasholders, the Corporation of Aberdeen have brought into use one of four million cubic feet capacity, which is the second largest in Scotland, and which, up to the present time, holds the position of having been erected at the cheapest rate per 1000 cubic feet capacity of any large holder in existence—a circumstance which is largely due to the well-directed energy of Mr. A. Smith, the Engineer and Manager. The Corporation of Glasgow are engaged in the erection of a new holder at their Tradeston works, which is to be of slightly less capacity than their six million holder, erected there a year or two ago. The Dumbarton Corporation have also brought into use a new holder, which was constructed to designs by Mr. J. M'Gilchrist, their Engineer and Manager. New holders are being constructed at Hamilton and Gourock, in connection with the latter of which it is notable that it is the first in which the powers of the Amendment Act of 1893, giving the Sheriff of a county authority to dispense with the consent of owners and occupiers of property within 300 yards of the proposed site of a holder, was exercised.

In June, the annual meeting of the Incorporated Gas Institute was held in Edinburgh, under the Presidency of Mr. R. Mitchell, Engineer and Manager of the Edinburgh Gas-Works, and proved a highly successful gathering. The North British Association of Gas Managers were no less successful with their annual meeting, which this year was held at Melrose.

The ranks of the brotherhood of gas managers have not, to my recollection, been thinned by death during the year; but a notable figure has passed, or is about to pass, from active work among them, through the resignation by Mr. T. Whimster, of the post of Engineer and Manager to the Perth Gas Commissioners. Mr. Whimster has been for more than 50 years connected with the gas supply of Perth. He goes into retirement with the sympathy and regret of all who knew him. He is succeeded by Mr. Andrew Wilson, son of Mr. T. Wilson, Manager of the Coatbridge Gas Company. Another change took place in the transference of the services of Mr. J. Donaldson from Cambuslang, near Glasgow, to Tonbridge, in Kent.

In the matter of water-works, the most extensive business consisted of the passing, practically unopposed, of an Act empowering the Edinburgh and District Water Trust to take in an augmented water supply from the Talla stream, which is one of the head-waters of the River Tweed. The source of supply was only agreed to after several years of agitation; but now that it has been sanctioned, the work is already in progress. The Falkirk and Larbert Water Trust have intimated a Bill for next session of Parliament for the augmentation of the water supply of their district. In Arbroath, the Police Commission adopted a report by Mr. J. Wilson, of Edinburgh, recommending that a gravitation water supply should be procured, in preference to extending their present supply from wells. But the ratepayers, at the municipal election, rejected the supporters of Mr. Wilson's scheme, with the result that the resolution to adopt it has since been rescinded; and it has been resolved to endeavour to get more water by extending the wells and pumping machinery.

Of electric light, it is not necessary to say much. The Edinburgh installation, which was inaugurated at the beginning of April, is claimed to have turned out a great success. Glasgow, Aberdeen, and Dundee already possessed installations of electric lighting; but in neither of them has there been the same success claimed. In Coatbridge, where an electric lighting company laid down plant under the ægis of Lord Kelvin, the motive power for the working of which was to be producer gas, the experiment has proved a failure; and producer gas has been relinquished in favour of steam. I am told this is accounted for by the fact that it takes three times as much producer gas to work an engine as it would require of coal gas. Anyone acquainted with the business can calculate on which side the economy lies. I am not aware of any other new installation of electric lighting than that of Edinburgh. In several places it is spoken of; but there is not at present a single Corporation, except that of Ayr—in which town an installation is all but completed—who are looking seriously at the subject. The Corporation of Paisley have, in fact, resolved to take no action under a Provisional Order which they obtained in 1891, and which must now be held to have lapsed. I had almost forgotten to say that the two insignificant places of Fort William and Pitlochry are probably to be lighted by electricity. But these will not affect the balance much; and there is thus every probability that the gas supply of Scotland will not be greatly changed by anything new in the electric lighting way in 1896.

A curious hitch has occurred in the arrangements for the taking of the plebiscite of the ratepayers of Dunfermline, upon the question of whether or not the Burghs Gas Supply Act should be adopted. The Gas Act, which was passed in 1876—four years subsequent to the passing of the Ballot Act—directs that the poll shall be taken "in the manner prescribed in regard to polls of householders taken with reference to the adoption of the General Police and Improvement (Scotland) Act, 1862." The procedure provided for in the latter statute is open voting; and the hours of polling are from 9 a.m. to 4 p.m. By the Burgh Police (Scotland) Act, 1892, the Act of 1862 and the amending Act of 1868 (which substituted a £4 for a £10 franchise) were repealed; and the question arises whether the procedure which the first measure prescribed is now non-existent. The 1892 Act, however, affords no guidance as to how a plebiscite is to be taken; and it does not repeal the Gas Act. The whole matter has been under the consideration of the Law Committee of the Town Council; and the feeling seems to be that should the modern form of voting be resorted to, objections might be raised and the proceedings invalidated, whereas if the strict letter of the Gas Act were adhered to, a large number of those now qualified to vote in municipal elections would not be allowed to exercise the privilege. It is evident that the 1862 and the 1868 Acts must be read together. But even with the £4 franchise, it would only be male householders whose names appear on the valuation roll—not the voters' roll—who would be entitled to vote. Landlords who are not occupiers, and also ladies, would thus be disfranchised. It has been decided to take the opinion of Mr. J. B. Balfour, Q.C., late Lord Advocate for Scotland, on the subject. The difficulty would appear to arise through the omission to repeal the provision of the Burghs Gas Supply Act of 1876 when the 1892 Act was passed. It does not appear very clear how procedure under the Police Acts of 1862 and 1868, which have been repealed, could be followed. In that case, the machinery for taking the vote under the Act of 1876 having been abolished, it would seem to the lay mind that no vote can be taken; but it is purely a question of law. The most awkward point in the matter is the fact that the 1876 Act did not adopt voting by ballot, which had been in existence for some years; and this seems to point to the fact that the old, and now abolished, form was intentionally retained.

This has been a period of fog and darkness such as I do not remember. The gas consumption for the past month must have been very large. In Glasgow, in the end of last week, there was much fog; and on the morning of last Saturday Mr. Foulis, the Gas Engineer, stated that on the preceding day the output from the city gas stations amounted to 29 million cubic feet—a record output for the Corporation.

There is at present an industrial exhibition being run in the east-end of Glasgow. It is, of course, lighted by electricity; and in connection with the installation there is an important novelty, in respect that the generating plant is driven by gas-engines constructed according to the patent of Messrs. Burt and M'Ghee—the makers being the Acme Engineering Company, of Glasgow. The peculiarity of these engines is that they are coupled direct to the dynamos, and work up to a speed of 380 revolutions per minute, giving a horse power of 150 indicated. They work without a hitch. The engines have four cylinders, each 12 inches in diameter, working a double-throw crank; two cylinders working tandem to each crank. Two of the engines, it is reported, have been ordered by the Belfast Corporation for working electric lighting plant in that city.

The Edinburgh Corporation are in danger of being intoxicated with electricity. This week the Electric Light Committee—who are now the Lighting Committee of the city—agreed to submit to the Council a scheme for the extension of the street lighting installation in various directions; the number of lamps included in it being 135, and the capital cost £2678. This, at £18 per lamp, the sum which it is proposed to charge, means an annual outlay of £2400 for street lighting. There is already a charge of £5000 for this purpose; so that the ratepayers will be called upon to pay over £7000 a year for the lighting of a few thoroughfares, which is just about half what the total lighting of the city by gas cost a few years ago. Only the leading thoroughfares are getting the new light. Of course, residents there secure it largely

at their neighbours' cost; and thus the motto of the Committee would seem to be:—

> Let struggling side-street traders' profits die,
> But, oh! adopt our electricity.

The Committee have given instructions for the removal of the gas-lamps in Princes Street, as being now unnecessary. This may be right enough, though a little risky; but taken along with the fact that there is no mention of any extension of incandescent gas lighting in the streets, I am afraid it points in the direction of there being a degree of one-sidedness in the matter of public lighting which ought not to exist. In Glasgow, the Corporation are increasing the incandescent gas lighting. They have now extended it along the whole length of the important south-side thoroughfare of Eglinton Street. It is evident that they wish to give both systems of lighting fair play, and are prepared to promote the one which is most suitable and most economical.

There is a proposal at present for the extension of the Renfrew Corporation Gas-Works; and in connection with the proposal, the suggestion has been made that, instead of extending them, the Corporation of Glasgow should be approached and asked to supply gas in the town at Glasgow prices. This is next to impracticable. In the first place, it is not likely that the Corporation of Glasgow would undertake to supply gas in an out-township at the same rate as in the city; and, in the next place, there is the capital of the Renfrew gas undertaking—standing, according to the latest return I have, at £5750—which would have to be disposed of. Before the Corporation of Renfrew could give up their exclusive right to supply gas in the burgh, they would either have to wipe out that sum, which would be a loss to the burgh, or the Corporation of Glasgow, before they could acquire right to supply gas in the burgh, would have to take it over—neither of which is probable. If there were a proposal for a general amalgamation, such a scheme might be carried out; but I do not think that is even in the air yet.

The Greenock Gas Trust had the subject of the purchase of coal and oil before them in a somewhat peculiar manner last week. The minutes of the Gas Committee recommended that a Sub-Committee of seven should have power to negotiate for the purchase of coal and oil and the sale of residual products, as the condition of the markets might determine during the year. This was a very large order on the confidence of the Corporation; and it was naturally opposed. Instead, however, of meeting the innovation with a direct front, the opposing proposal was merely that the Sub-Committee should have power to make inquiry about coal and oil, and to report; and that they have the control of the sale of residual products. The proposal of the Committee was adopted by nine votes to seven; but there was a good deal of confusion among the members—so much, indeed, that seven of them declined to vote—and notice of a motion to rescind the appointment of the Sub-Committee was given. The motion should certainly be rescinded. It is not, generally speaking, a workable scheme. It might do with the present Sub-Committee; but before a year elapses there might be a change in the composition of the Sub-Committee, and the scheme gives too much power into the hands of a practically irresponsible Committee to be safe.

The income from the sale of the gas residuals made at the gas-works of the Glasgow Corporation shows a very decided falling-off in the present financial year, which began on June 1, 1895. During the five months ending Oct. 31, the revenue from residual products amounted only to £50,995, as compared with £60,056 in the corresponding five months of the financial year 1893-4. These figures prove that the decrease of revenue at Oct. 31 amounted to £9061. If the same rate of decrease goes on over the whole of the current financial year, there may be a falling off in revenue from this source of income of something like £20,000 when the next balance is made up by the Treasurer.

The gas-works at Earlston are after all likely to be acquired by the Police Commissioners. The owners of the works and the Commissioners appeared to have difficulty in coming to terms; but it is now announced that the owners are prepared to sell at £750, and that the Commissioners are to make an effort to accept the offer. The works were to have been closed on the 31st inst.; but if an agreement be come to, as is likely, the gas supply will be continued.

The Gas and Electric Lighting Committee of the Aberdeen Town Council met on Tuesday, and opened twelve tenders for the supply of an engine and exhausters for the gas-works. The offers were remitted to Mr. Smith, the Manager, for a report. Two days later the Commttee met and agreed to let the contract to Mr. G. Waller, of London, at the price of £584. It was reported that sanction had been given to the Committee by the Secretary for Scotland for further borrowing powers in connection with the electric lighting installation of the Corporation. They are evidently in want of money there, particularly in the matter of public lighting, which, as in Glasgow, is not so good as it might be. The Corporation are adopting the method, as an experiment in one or two streets, of stringing the arc lamps across the roadway; but I do not expect that this will improve matters. The lamps are too far apart; but, worse than that, they are not very effective for street lighting. There is too much darkness on the under side of the globe—nearly one-third of the whole diameter, I should say, is dark—which has the result of making only one or two degrees of the circle give out effective lighting. The remaining upper part of the globe is quite bright; but the light is lost in space. The inhabitants, I presume, pay for the lighting of their own streets, and not of other worlds; and I am not surprised that there should be dissatisfaction with the street lighting.

The Arbroath Town Council met in committee yesterday to consider the representations made to them last week by representatives of the £3500 Harbour bondholders. After discussion, the meeting instructed the Town Clerk to reply to Messrs. Miln and Dalgarno, as representing the bondholders, that they did not at present see their way to do anything in regard to the bonds or the interest thereon. If further action is to be taken, therefore, it must be in the Law Courts.

Balmoral Castle is to be lighted by electricity, for which the electricians may well say "let us be truly thankful." Hitherto Royal favour has not leaned in the direction of the latest gift of Providence to the gas-ruined population of these isles; and it may be that when Mr. W. H. Preece a year or two ago announced that electricity was to be the poor man's light, he did so in despair of nobbling the wealthy. Now, however, that the Sovereign has come to their aid, who is prepared to say what amount of advertisement her action will be made to carry? The motive power is to be derived from a tributary of the Dee, named the Gelder; and as the Court does not reside at Balmoral during the winter months, the arrangement will be quite feasible, as the works will not be interfered with by frost during Her Majesty's stay. In the meantime, it is only the ball-room which is to be lighted by electricity, at a cost of about £1400; but it is said—and here the old feature of the electric light man shines out—"ultimately, no doubt, all the rooms of the Castle will be supplied."

Another great announcement on the same subject comes from Pitlochry. I stated a week or two ago that Professor George Forbes, the hero of the Niagara Falls electric adventure, had formulated a scheme for the lighting of the village of Pitlochry with electricity generated by some of the natural waterfalls in the neighbourhood; and that it was hoped that the local Gas Company would take up the scheme. The Company have considered it, which is scarcely credible; but then one does not know all the local circumstances. The Directors met the other day, and resolved to give Professor Forbes a retaining fee of £50 to show his plans. The proposal is to utilize the Falls of Tummel to drive a turbine of 200-horse power; and the expectation is that the whole scheme will be completed for £2000. The immensity of the scheme does not make anyone stand aghast; but the proposal that the residents in Pitlochry should interfere with the Falls of Tummel is a little disturbing. What would Pitlochry be without its falls? To take them away would seem to be something like "killing the goose that lays the golden eggs;" but the pity is that the unsophisticated will not find that out till the egg is gone.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 28.

Sulphate of Ammonia.—Throughout the week, the market has been quiet; but there has been a fair amount of buying, and prices have been about maintained. The quotations are £8 10s. to £8 12s. 6d. f.o.b. at the ports. In the forward position, there has been considerable inquiry; but, notwithstanding the low prices quoted, buyers do not seem keen of operating. No doubt the low range of prices of all nitrogenous and ammoniacal material has much to do with the attitude of buyers towards sulphate of ammonia; but it should be pointed out that sulphate of ammonia is relatively the cheapest, and should be well worth attention. White nitrate of soda works out at over 8s. per unit on the ammonia basis, but sulphate is only worth about 7s. per unit; thus showing a substantial margin in favour of the latter.

Nitrate of Soda is steady at 7s. 7½d. per cwt. for ordinary quality, and 7s. 9d. per cwt. for refined. The position of cargoes afloat is unchanged.

LONDON, *Dec.* 28.

Tar Products.—This market is quite demoralized by the holidays. Very little new business has transpired; and the tendency of buyers is to wait until the turn of the year before concluding forward purchases. Benzols do not retain their briskness, and are quoted weaker. Solvent naphtha is in steady demand; and there is considerable inquiry for crude naphtha, and, in one or two instances, high prices have been paid for forward contracts, evidently in the hope that benzols will yet see higher values. This is somewhat unlikely, as, though the advance in price has not yet deterred gas manufacturers from continuing the use of benzol for the enriching of gas—as, even with the increased price of benzol, its use does not cost more than 1d. per candle, which makes it still the cheapest enricher—the season will soon be over; and the German production is being largely increased from coke-ovens. There is still a good inquiry for carbolic acid, both liquid and crystals. Anthracene is firm, but other products are somewhat neglected.

The following prices have been obtained during the week: Tar, 18s. 6d. to 24s. Pitch, nominal, 33s. 6d., west coast; 37s., east coast. Benzols, nominal, 90's, 2s. 3d.; 50's, 2s. Solvent naphtha, 1s. 4d. for shipment; 1s. 6d. for home consumption. Toluol, 1s. 10d. Crude 30 per cent. naphtha, 10d. Creosote, 1¼d. Naphthalene, pressed, 45s.; drained, 27s. 6d. Cresylic acid, 1s.; crude, 10d. Carbolic acid, 60's, 1s. 9d.; 75's, 2s. Anthracene, "A," 1s.; "B," 9d. to 10½d. The prices here quoted are usually subject to discount.

Sulphate of Ammonia continues weak; and the market is entirely in the hands of buyers. Sales have been made during the week at the following rates: Beckton, £9; London, outside makes, £8 12s. 6d.; Hull, Leith, and other east-coast ports, £8 11s. 3d.; west-coast ports, £8 10s. to £8 12s. 6d., less 3½ per cent. f.o.b.; while the value of gas liquor is taken at 6s. to 7s. per ton for 10-oz. liquor.

THE LANCASHIRE COAL TRADE DURING 1895.

(From Our Own Correspondent.)

Perhaps the most noticeable feature in the coal trade of Lancashire during the past year has been the exceptionally low point to which prices for all the poorer qualities of round coal have fallen. This has been owing to the excessive supplies offering in the market, notwithstanding the pits generally have been working shorter time than has been known for a good many years past. The inferior descriptions of round coal have not been so low for the last eight or ten years; and common coal pits during the greater part of the year have scarcely been working half time—many of them not more than two to three days per week. The higher qualities, suitable for house-fire purposes, have relatively scarcely been in any better position; prices for these having also ruled very low all through the year—commencing on the basis of about 10s. 6d. to 11s. per ton for best Wigan Arley; 9s. 6d. to 10s. for Pemberton four-feet and seconds Arley; and 7s. 6d. to 8s. for common house-fire coals. They improved upon these figures about 6d. per ton during the exceptionally severe weather which characterized the first

three months of the year. The ensuing summer, however, with a marked (almost complete) absence of demand for house-fire purposes, brought prices down quite 1s. per ton below these figures; and although there was some recovery with the opening of winter inquiries, the year closed with best Wigan Arley not averaging more than 10s. to 10s. 6d. per ton, Pemberton four-feet and seconds Arley 9s. to 9s. 6d., and common house-fire qualities 7s. to 7s. 6d.—or about 6d. below even the exceptionally low figures ruling at the opening of the year. The very unsatisfactory state of the house-fire coal trade, coupled with the excessively low prices which colliery proprietors had to take to effect clearances of the inferior qualities of round coal, necessarily very early on in the year induced considerable anxiety on the part of colliery owners with regard to the usual gas-coal and locomotive fuel contracts. Last year a sort of combination was attempted, with a view of settling some basis for prices, and thus preventing undue competition for these contracts. But the arrangement proved altogether a failure—some of the leading colliery owners complaining that it had only been made use of to keep them out of many of the contracts. This year one or two of the largest Lancashire colliery concerns evidently determined that they would run no risk of being cut out of this season's contracts; and when inquiries for gas contracts began to appear in the market during April, it was at once manifest that there was to be an exceedingly keen competition to secure them. At the very outset, tenders were sent in based upon reductions of 1s. to 1s. 3d. per ton upon the prices which were ruling for the previous year's contracts. One or two contracts were placed on the basis of 6s. 6d. per ton at the pit for good screened Wigan four-feet, and 7s. to 7s. 3d. for partially screened Arley. But as the season progressed, prices were gradually cut down until the average basis on which contracts were placed represented about 6s. to 6s. 3d. per ton for Wigan four-feet, and 6s. 6d. to 6s. 9d. for partially screened Arley. One or two important contracts which were placed late on in the season were accepted at about 3d. per ton under even these very low figures, which represented a giving way of quite 1s. 6d. upon the prices obtained last year, which ranged from about 7s. per ton for the commoner, to 8s. and 8s. 6d. for the better qualities of screened gas coal. Locomotive fuel contracts were this year settled at about 6d. under last season's prices; the average basis being 6s. 3d. per ton at the pit mouth. In the common qualities of round coal, suitable for iron-making, steam, and general manufacturing purposes, except that the extra pressure during the first three months for house-fire consumption helped to take off the market some of the surplus supplies, steam and forge coals have all through the year continued a complete drug, with prices, as already stated, touching perhaps the lowest point since 1886-7. During the earlier part of the year, common round coals were fetching from 6s. 6d. to 7s. per ton at the pit; but with the falling off in requirements for house-fire consumption, and only a very limited demand for general manufacturing purposes, the excessive supplies offering in the market compelled sellers to take exceedingly low prices to effect clearances. Upon ordinary inland sales it became difficult to get more than 6s. per ton at the pit for good qualities of steam and forge coal; while for shipping orders, 5s. 6d. was readily taken, with needy sellers in some cases at as low as 5s. per ton. Even the revival of activity in the iron trade and other branches of industry during the latter part of the year, has had no really appreciable effect in improving the position as regards the lower qualities of round coal; the increasing requirements for manufacturing purposes having so far only very partially overtaken the excessive output. With the close of the year, 6s. to 6s. 6d. per ton at the pit still represent about the average figures for inland sales of good qualities of steam and forge coals, with 5s. 6d. to 6s. very generally taken for shipment. With regard to engine classes of fuel, the better qualities of slack—supplies of which have necessarily fluctuated with the demand for round coal—have been fairly steady; 4s. 6d. to 5s. per ton at the pit mouth representing an average basis, from which there has been comparatively little variation. For the commoner sorts, however, prices have been irregular. At the commencement of the year, about 3s. 6d. to 3s. 9d. and 4s. per ton was obtained for ordinary common slack; but with plentiful supplies coming upon the market, very low prices were in many cases taken for contracts, and there were sellers in the market at as low as 2s. 9d. to 3s. per ton. The closing pit-prices were from about 3s. per ton for inferior, to 3s. 6d. for good, ordinary Lancashire slack.

COAL TRADE REPORTS.

From Our Own Correspondents.

Northern Coal Trade.—The week has been broken by the holidays; but the effect has been to lessen the production, and to allow a fuller demand to accumulate, so that the work at the pits has been better. In steam coal, there is not yet full work generally; but the position is a little better than it was. The price of best Northumbrian steam coal is still 8s. per ton f.o.b.; and steam smalls are 3s. 9d. There are now negotiations for contracts for the next few months; but it is rather doubtful what the rates really will be. Household coals meet with a steady demand; but it is below that which is usual at this time of the year. For shipment, the price varies from 10s. to 11s. per ton f.o.b. In gas coals, the deliveries continue at their highest point; and most of the collieries are fully at work, with a demand that will tax the output for a month or so to come. For single cargoes, the price is still 6s. 6d. to 7s. per ton f.o.b. Smithy coals meet just at present with only a moderate inquiry; and manufacturing coals are dull, several of the factories being idle for a fortnight, as is frequently the case here at the holidays. In other branches of the coal trade, there are not many alterations to notice. Coke is very steady; and for export the price ranges from 14s. 6d. to 14s. 9d. per ton f.o.b. There is a rather better demand for coke from the north-western furnaces; and the local consumption is above the average. Coke makers here are therefore fully employed; and the price is a little better than it was a few months ago. Gas coke is steady; and several large contracts for sales to manufacturers have been made over next year, at prices which are substantially the same as those that ruled the present contracts. The facility for shipping gas coke to the Continent is one reason why the makers here command good prices.

Scotch Coal Trade.—Trade has been quiet, so many workmen being idle on account of the engineers' strike in the west leading to longer holidays being taken or enforced. Prices remain unaltered. Shipments last week amounted to 146,548 tons—an increase as compared with the quantity in the preceding week of 9577 tons, and as compared with the corresponding week of last year of 11,898 tons. For the year to date, the total shipments have amounted to 7,329,832 tons—an increase over the quantity last year of 2,080,835 tons.

Increased Carbonizing Plant at the Torquay Gas-Works.—A new retort-house, which increases the manufacturing capacity of the carbonizing plant by nearly 50 per cent., has just been erected at the works of the Torquay Gas Company at Hollacombe. Coal-breaking and charging and drawing machinery has been introduced, with the result that a great saving in manual labour has been effected. The Company also contemplate the introduction of prepayment meters.

The Public Lighting of Brighton.—At the last meeting of the Brighton Town Council, a resolution was passed instructing the Town Clerk to inform the Brighton and Hove Gas Company of the intention of the Council to determine on the 30th of June next the existing agreement for the lighting by gas of the public lamps in the borough, and authorizing him to enter into negotiations with the Company for a new agreement, reserving power to the Council to discontinue the lighting of any lamps on a month's notice being given at any time.

The Middlesex County Council and the Southwark and Vauxhall Water Bill.—Our readers may remember that, among the notices of intended applications to Parliament which appeared in the JOURNAL on the 3rd inst., there was one of a Bill, to be promoted by the Southwark and Vauxhall Water Company to empower them to construct two new pumping-stations at Harefield, which will be connected with conduits to and through this and other villages as far as Richmond Bridge, at which point the Company's main crosses the Thames. The conduit will be 16 miles long. The Middlesex County Council view this project with alarm; and they are going to join the London County Council in opposing it. The Parliamentary Committee of the Middlesex Council declare that the object of the Bill is to "convey Middlesex water into Surrey;" and they feel that, if the scheme is carried into effect, the Thames will be frequently dry. Sir F. Dixon Hartland, M.P., characterizes the Bill as the worst he has seen.

The Public Lighting Contract at Canterbury.—At the last meeting of the Canterbury Town Council, the question of the gas lighting contract again came up for discussion; the Canterbury Gas and Water Company having refused to defray the cost of placing twenty meters on lamps in various parts of the city. The Committee now recommended that the meters should be furnished and erected by the Corporation. Alderman Cross said this would entail a cost of £4 17s. 6d. per meter; and he strongly objected to such an expense being incurred, more especially as it was only a few years ago that £700 (of which the Gas Company paid £400) was expended on meters which had now been taken away. He contended that the Corporation were paying too much for gas, and said he relied on figures supplied by the City Surveyor in respect of the charges in other towns of similar size. Alderman Hart said the Secretary of the Gas Company had informed him that the figures were fallacious and incorrect. The Surveyor said he would risk his reputation on their correctness. Eventually, Mr. Lukey proposed, Mr. Sanderson seconded, and it was resolved, that the tender of the Company for £3 10s. per lamp be accepted; the burners to be equal to consuming 5 feet of gas per hour. The old contract was £3 12s. per lamp.

Abolition of Soot by Gas-Stoves: A Sweep's Complaint.—One of the most remarkable results in connection with the enormous extension of the prepayment meter system in large towns, is the present scarcity of soot. Where people burn gas to a large extent for heating and cooking purposes, there has necessarily been a decrease in the consumption of coal and other soot-producing fuel—to the benefit, of course, of the householder and to the public at large, but to the sorrow of the coal-dealer and the chimney-sweep. Indeed, one of the latter fraternity in the South-East of London puts to the credit of "penny-in-the-slot" meters the loss of more than half his trade. He asserts that whereas about this period of the year he could sell at least 500 sacks of soot for agricultural purposes, he is not now able to supply more than 50 or 60 sacks; so that he will have considerable difficulty in fulfilling the contracts he entered into when soot was almost too plentiful, because it "let down" the prices to a very low point. He anticipates that next year will be much worse, because many people have had their chimneys swept several times this year who will henceforward only require the services of the sweep about once a year; while the quantity of soot obtained per chimney per annum will not be equal to what was obtained in a single sweeping (four times a year) prior to the increase in the number of users of gas-stoves.

The Public Lighting of Crayford.—At the last meeting of the Crayford District Council, the Clerk reported that the West Kent Gas Company had offered to light the public thoroughfares all night at a cost of £4 2s. 6d. per lamp per annum, and erect standards at £3 each—this sum to include the provision of mains and service-pipes where necessary. The Chairman proposed that this offer be accepted. Mr. Miles seconded the motion. Mr. Battison moved that the matter be referred to the Lighting Committee, as he did not think the Company had quoted a reasonable rate; their tender for erecting the columns being £25 above any of the other tenders. Mr. Peill seconded the amendment. Mr. Brewer asked if the Lighting Committee had considered the question of oil lighting. The Chairman replied that oil lighting was too antiquated and inconvenient. Mr. Brown said the Committee had considered the various systems of lighting very carefully and minutely; and they could not recommend oil. Mr. Miles said all the members knew that in the neighbouring town of Erith they had oil lighting. At Erith, the oil-lamps went out on windy nights; and the place was practically in darkness. Indeed, when the oil-lamps were at their best they only served to make the darkness more visible, for they could scarcely be seen from one to another. In the end, the motion was carried; there being only two votes against it.

Another Trial of the Yeadon Retort at Leeds.—At their last meeting, the Leeds Corporation Gas Committee decided to have another series of trials with the Yeadon revolving retort, to further test its advantages for distilling coal, and also for revivifying gas lime.

The Illuminating Power of Leeds Gas.—At a recent meeting of the Leeds Corporation Gas Committee, a letter was read from the Clerk to the Justices calling attention, at the request of the Justices' Committee, to the low illuminating power of the gas for the past month, according to the report of Mr. Buckley, the Inspector. The Committee decided to send to the Magistrates a copy of Mr. Fairley's report upon the illuminating power, giving more satisfactory results of tests for the same period.

The Purchase of the Clonmel Gas-Works by the Corporation.—At an extraordinary meeting last week of the Clonmel Corporation, a resolution was proposed sanctioning an application by the Parliamentary Committee to the Provincial Bank for a loan of £14,000 for the purchase of the gas-works; the money to be advanced by way of overdraft, bearing interest at the rate of 4 per cent. Alderman Higgins said he was glad this business, which was of great importance to the town, was being completed in such a satisfactory manner. All that remained to be done was to get the deed of transfer executed; and the Corporation could go into possession. The resolution was passed unanimously.

Cromer Gas Company.—The annual general meeting of this Company was held on Monday last week—Mr. G. Breeze in the chair. The accounts showed a profit of £631, as compared with £688 last year. Taking into account the diminution of income caused by the reduction in the charge for gas and the lower price received for residuals, and by the expenditure of £100 in the enlargement of existing mains, the Directors considered the year's results contrasted favourably with those of the previous twelve months. The profit added to the outstanding balance brought up the total of the profit and loss account to £1024; and, after the transfer of £200 to the reserve fund, and the payment of bank interest and the interest on debenture stock, there remained a balance of £678, from which the Directors recommended the payment of a dividend at the rate of 6 per cent. per annum free of income-tax, leaving a balance of £258. The Chairman said the reduction in the price of gas had cost them one-twelfth of their income; and, under such circumstances, it was very satisfactory that they were able to recommend a dividend of 6 per cent. They thought the time had come for the enlargement of the trunk main to the town; and it was proposed to carry out the work in the coming spring. He moved the adoption of the report; and it was unanimously agreed to.

The Progress of the Hinckley Gas Undertaking.—In the brief announcement which appeared last week of the advance in the salary of Mr. G. Helps, the Manager of the Hinckley Gas-Works, we did not give him all the credit which is his due for the progress made in the gas undertaking of the District Council in the short time he has been connected with it. The extent of this progress will be shown by the following figures: In the year ending Sept. 30, 1893, the quantity of gas sold was 30,018,000 cubic feet, of the net value, in round figures, of £5155; and there was a sum of £522 arrears outstanding. In the year ending Sept. 30 last, the sales reached 39,277,000 cubic feet (a rise of 9,259,000 feet), of the net value of £6725; while the arrears had been brought down to £279. The revenue had in the two years increased by £1568, while the arrears had been reduced by £243. But this is not all. In the first-named year, the net value of the residual products, &c., sold was £1775; and the arrears amounted to £806. At the end of September last, their net value was £2213; while the arrears were only £178—a rise in the one case of £438, and a fall in the other of no less than £628. The Gas Committee had these figures before them when the decision was come to to recognize in a substantial manner the good management which had produced them.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1340.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	22½–23½	..	4 9 5
100,000	10	,,	7½	Do. 7 p. c.	10	16½–17½	..	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	..	4 11 9
200,000	5	14 Nov.	6¼	Bombay, Limited	5	6⅞–7⅛	..	4 9 8
40,000	5	,,	6¼	Do. New	4	5–5¼	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	268–273	..	4 7 11
180,000	,,	,,	9	Do. New	100	210–215	..	4 3 9
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227–232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	124–128	..	3 18 1
320,000	20	27 Sept.	11½	British	20	54¼–55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½–23½	..	4 17 10
51,510	10	,,	8½	Do. 7 p. c.	10	19–20	..	4 5 0
328,750	10	14 Nov.	¿	Buenos Ayres (New) Limited	10	7⅞–8⅛	..	4 17 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102–104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	30–32	..	5 3 3
550,000	Stck.	26 Oct.	13½	Commercial, Old Stock	100	323–328	..	4 2 4
165,000	,,	,,	10½	Do. New do.	100	251–255	..	4 2 4
160,762	,,	16 Dec.	4½	Do. 4½ p. c. Deb. do.	100	147–152*	..	2 19 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited.	100	263–268*	–5	4 17 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	210–215*	..	4 13 0
535,000	Stck.	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	127–132	..	3 19 6
486,090	10	26 July	11	European, Limited	10	25½–26½	..	4 3 0
351,060	10	,,	11	Do. Partly paid	7½	17–18	..	4 14 3
5,646,590	Stck.	14 Aug.	12½	Gaslight & Coke, A, Ordinary	100*	295–300	..	4 5 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107–112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	287–292	..	3 8 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135–140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200–205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193–198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	287–292	..	3 8 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf..	100	169–173	..	3 9 4
1,061,150	,,	16 Dec.	4	Do. 4 p. c. Deb. Stk.	100	135–140*	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145–150*	..	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	200–205*	..	2 18 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	232–236	–1½	5 1 8
75,000	5	16 Dec.	6	Malta & Mediterranean, Ltd.	5	6–6¼*	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113–116	..	4 6 2
541,920	20	14 Nov.	5	Monte Video, Limited	20	16⅞–17⅛	..	5 14 3
150,000	5	28 Nov.	8	Oriental, Limited	5	7⅞–8⅛	..	4 16 11
60,000	5	12 Sept.	7	Ottoman, Limited	5	5–5¼	..	6 7 3
166,870	10	14 Feb	2	Para, Limited	10	1¾–2	..	11 8 6
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	105–110	..	5 9 1
500,000	100	9 Dec.	6	2nd Do.	100	103–105	..	5 14 3
150,000	10	16 Oct.	7	San Paulo, Limited	10	11–12	..	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	377–382	+2	4 1 2
1,350,000	,,	,,	12	Do. B do.	100	308–313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325–330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175–178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	250–255	..	4 10 2
				WATER COMPANIES.				
746,021	Stck.	26 June	10½†	Chelsea, Ordinary	100	297–302	..	3 7 10
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	215–220	..	3 3 7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157–162	..	2 15 6
700,000	50	16 Dec.	6½	Grand Junction	50	112–117*	+2½	2 15 6
708,000	Stck.	29 Aug.	12†	Kent	100	310–315	..	3 16 2
1,043,800	100	26 June	7½†	Lambeth, 10 p. c. max.	100	247–252	..	2 17 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	210–215	..	3 7 6
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143–148	..	2 14 2
500,000	100	14 Aug.	12½	New River, New Shares	100	380–390	..	3 3 7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143–148	..	2 14 2
902,300	Stck.	16 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	150–155*	..	3 17 5
126,500	100	,,	6	Do. D 7½ p.c. do.	100	139–142*	..	4 4 6
1,155,066	Stck.	16 Dec.	10	West Middlesex	100	283–293*	..	3 8 3

† Next dividend will be at this rate.

*Ex div.

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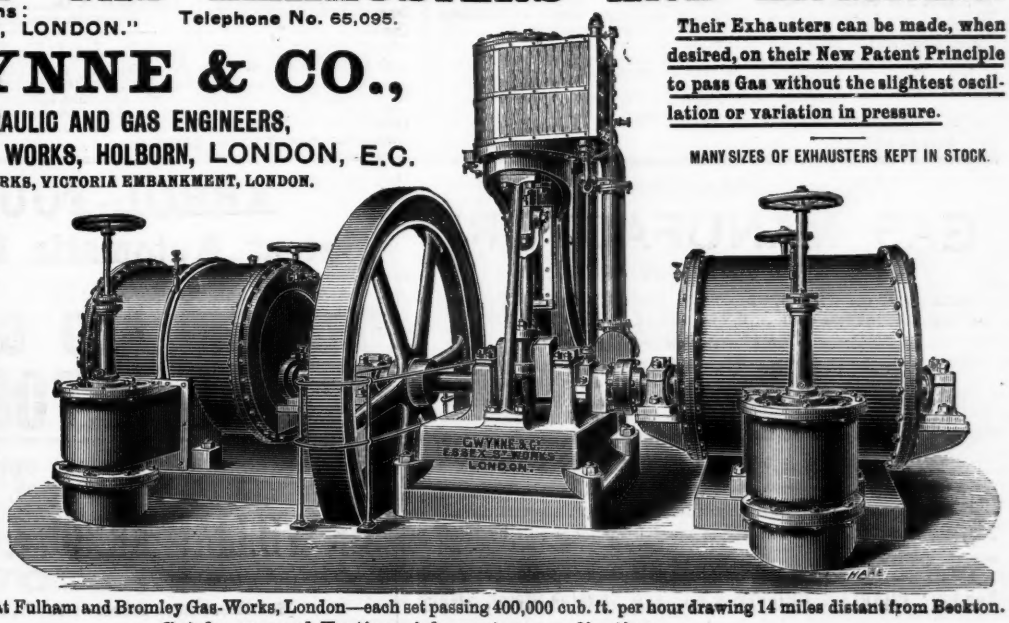

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THE RELIANCE LUBRICATING OIL COMPANY will SUPPLY on APPROVAL 40-gallon Barrels "RELIANCE" NON-CORROSIVE LUBRICANTS (which, through their superiority, have the largest sale in the world)—viz., Engine, Cylinder, and Machinery Oils, 11½d.; Spindle Oil, 8½d.; Gas-Engine and Dynamo Oils. 1s. 6d. per gallon; Barrels Free and Carriage Paid. Also Solid and Liquid Lubricants for all other purposes.
RELIANCE LUBRICATING OIL COMPANY,
19 & 21, WATER LANE, GREAT TOWER STREET, LONDON, E.C.

GAS-FITTER wanted. Good steady Workman, used to Meters, Cookers, and Compo. and Iron. Wages, 32s. 6d. a week.
Apply, with References, to C. MEIKLEJOHN, Gas-Works, RUGBY.

THE Directors of the Plymouth and Stonehouse Gaslight and Coke Company require the services of an INSPECTOR.
Salary to commence at £170 per Annum. Age not exceeding 35 years.
Applicants must have a practical knowledge of Laying Gas-Mains and Service-Pipes, also the Testing and Fixing of Meters, taking Pressure, and the general routine connected with the Distribution Department.
Applications, stating recent experience, and accompanied by Testimonials (three only) as to ability and character, and endorsed "Inspector," to be sent to the undersigned not later than Monday, the 13th of January, 1896.

By order,
JOHN THOMAS,
Secretary.

Gas Offices: 1, Athenæum Terrace,
Plymouth, Dec. 27, 1895.

FOR SALE—The Numbers of the *Journal of Gas Lighting*, for 1879, 1880, 1881, 1882, 1884, 1885, 1889, 1891, and 1892; and of the *Gas World*, for 1890, 1891, 1892, 1894, and 1895. Also 120 Parts (from A to W) of the "Practical Dictionary of Mechanics."
Address JOHN JAMES, 30, Home Gardens, Dartford, KENT.

Now Ready, Handsome Cloth, 9s. Post free,

GAS MANUFACTURE

(THE CHEMISTRY OF);

HANDBOOK ON THE PRODUCTION, PURIFICATION, AND TESTING OF ILLUMINATING GAS, AND THE ASSAY OF THE BYE-PRODUCTS OF GAS MANUFACTURE.

For the Use of Students.

BY W. J. ATKINSON BUTTERFIELD, M.A., F.C.S.,

Head Chemist, Gas-Works, Beckton, London, E.

WITH NUMEROUS ILLUSTRATIONS.

*** This work deals with the MOST MODERN DEVELOPMENTS of the subject; and the chapter treating of the BYE-PRODUCTS will be found of special interest.

London: CHARLES GRIFFIN & Co., Ltd., Exeter Street, Strand.

ARROL-FOULIS
Patent Automatic Machinery
FOR
DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,
GLASGOW.

[See Illustrated Advertisement, Dec. 3, p. 1165.]

FOR SALE, Cheap—A Small GAS-HOLDER, 40 feet diameter, by 12 feet deep. In good condition.
Apply to the MANAGER, Gas-Works, Sandown, I. of W.

FOR SALE—A Second-hand Wrought-Iron WASHER-SCRUBBER, 30 ft. by 3 ft. 6 in., with 6-inch Valves and Connections. In working order.
Address the RUGELEY GAS COMPANY, LIMITED, Rugeley, STAFFS.

FOR SALE—A Small Gasholder, 24 feet diameter, 11 feet high, with Four Columns, Back Balance Weights, and Inlet and Outlet Valves. In good condition, and present use.
Apply to JAMES Y. M'DONALD, Secretary, Gaslight Company, Galston, AYRSHIRE.

FOR SALE—All the Gas Plant at East Bridge Street, Falkirk, comprising—
HYDRAULIC MAIN, 50 ft. by 14 in. by 14 in. ∪ shape, in Six Sections.
Twenty ∩ MOUTHPIECES, 24 in. by 14 in., with Doors and Screws, 6-inch ASCENSION-PIPES and BRIDGE PIPES.
One set of Annular CONDENSERS, 6-inch Connections.
Four PURIFIERS, 12 ft. by 8 ft. by 4 ft. 6 in., with Hydraulic Valves and Lifting-Crane. CORRUGATED IRON ROOF over Purifiers, with Six Cast-Iron Columns.
One STATION METER, by Milne, 4-inch Connections.
Three GASHOLDERS—One 40,000 Cubic Feet, in Cast-Iron Tank, with Six Columns and Counterbalance Weights; one 14,000 Cubic Feet, with Four Columns; and one Telescope Holder, 9000 Cubic Feet. Four Columns and Counterbalance Weights.
The Plant may be inspected on application to the Manager, P. B. Watson.
Offers will be received for the whole or any part of the Plant, as offerers see fit.
The Commissioners do not bind themselves to accept the highest or any offer.
Offers to be lodged with
JAMES WILSON,
Town Clerk.
Burgh Buildings, Falkirk,
Dec. 13, 1895.

TO IRONFOUNDERS.

THE Urban District Council of Buxton invite TENDERS for the supply of 1000 yards of 8-inch Turned and Bored GAS-PIPES.
Particulars to be obtained of Mr. Geo. Smedley, Town Hall, Buxton.
Tenders, endorsed "Tender for Gas-Pipes," to be sent in not later than the 4th of January, addressed to the Chairman of the Gas Committee.
By order,
JOSIAH TAYLOR,
Clerk.
Town Hall, Buxton,
Dec. 19, 1895.

TO RETORT & FIRE-BRICK MANUFACTURERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, BLOCKS, and FIRE-CLAY required at the Gas-Works during the ensuing Twelve Months.
Forms of Tender may be obtained from Mr. T. O. Paterson, Gas Engineer, Gas-Works, Thomas Street.
Tenders, sealed and endorsed "Tender for Retorts, &c.," to be sent in to me not later than Five o'clock in the Afternoon of Friday, the 3rd of January, 1896.
The Corporation do not bind themselves to accept the lowest or any tender.
By order,
ALFRED GILL,
Town Clerk.
Town Hall, Birkenhead,
Dec. 23, 1895.

THE URBAN DISTRICT COUNCIL OF ENFIELD.

TO ENGINE MAKERS.

THE Urban District Council of Enfield is prepared to receive TENDERS for the construction and erection of Two PUMPING-ENGINES, &c.
Copies of the Drawing and Specification can be obtained at the Office of the Engineers, Messrs. John Taylor, Sons, and Santo Crimp, 27, Great George Street, Westminster, on payment of One Guinea, which will be returned upon receipt of a *bonâ-fide* tender.
Sealed tenders, endorsed "Tender for Pumping-Engines," to be sent in to me not later than Noon, on Wednesday, the 15th day of January, 1896.
The Council does not bind itself to accept the lowest or any tender.
By order of the Council,
T. W. SCOTT,
Clerk.
Court House, Enfield,
Dec. 23, 1895.

SOUTH METROPOLITAN GAS COMPANY.

SALE BY TENDER OF £30,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE, £172½ PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £30,000 of Five per Cent. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the South Metropolitan Gas Act, 1882.
Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and tenders must be sent in on or before Wednesday, the 1st day of January, 1896.
The Stock will be allotted to the highest bidders; but no tender will be accepted at a lower price than at the rate of £172½ money for each £100 Debenture Stock.
By order,
FRANK BUSH,
Secretary.
Offices: 709A, Old Kent Road, S.E.,
Dec. 7, 1895.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m., on Tuesday, the 7th day of January next, and will be RE-OPENED immediately after the Half-Yearly General Meeting of the Company to be held in the month of February next.
By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.
Chief Office: Horseferry Road,
Westminster, S.W., Dec. 28, 1895.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS.

By N. H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NOTICE.

Whereas it has come to the knowledge of the INCANDESCENT GAS LIGHT COMPANY, Limited, of Palmer Street, Westminster, that a Company called the "Meteor" Incandescent Lighting Company, Limited, is selling and offering for sale a form of Incandescent Gas Light known as the "Meteor" Incandescent Gas Light.

This is to Give Notice that the Incandescent Gas Light Company, Limited will commence actions for infringement of their Patents against all persons found dealing in any manner with the said "Meteor" Incandescent Gas Light which is constructed in infringement of the Patents of the Incandescent Gas Light Company, Limited. The validity of these Patents has been established, and a certificate to that effect has been granted, by the Hon. Mr. Justice Romer.

FAITHFULL & OWEN,
11, Victoria Street, S.W.
Solicitors to the Incandescent Gas Light Company.

NOTICE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, Hereby Give Notice, that a Firm of F. J. Putz & Co., 16 and 17, Great St. Helen's, London, are advertising for sale Incandescent Gas-Light Apparatus called the "Champion" Incandescent Gas-Burner, and are stating in their circular that such Apparatus may be legally sold throughout the United Kingdom without Infringement of any existing Patent.

This is to Give Notice to the Public and the Trade that Actions for Infringement of Patent and for an Injunction will be immediately commenced by the Incandescent Gas-Light Company, Limited. against any persons using or selling such Apparatus.

The validity of the Company's Patents has already been certified by Mr. Justice Romer; and Solicitor and Client costs will be enforced in all cases.

FAITHFULL & OWEN,
11, Victoria Street, S.W.
Solicitors for the Incandescent Gas-Light Company, Limited.

NOTICE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

> "The Incandescent Gas-Light Company, Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo,* Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—

> The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it, he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others,* the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.

(Signed) FAITHFULL & OWEN,
Solicitors for the Incandescent Gas-Light Company, Limited.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF

NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

PARK STREET, SOUTHWARK, E.C.,

And at STROUD, GLOUCESTERSHIRE.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,

SPANNERS, RATCHET BRACES, LIFTING JACKS,

ANVILS, VICES,

AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,

BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1)	1·276
Weight of One Cubic Foot	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham, 8th August, 1894.

For Price, &c., apply to the

Wharncliffe Woodmoor Colliery Co LIMITED,

BARNSLEY;

Or to Mr. W. H. HARVEY,

17, Old Queen Street, Westminster, S.W.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 31, OLD BROAD ST., E.C.

TO ENGINEERS & MANAGERS.

ESTABLISHED OVER 50 YEARS.

This is to certify that I, SAMUEL NELSON, am the only ORIGINAL MAKER of the SOLID LEAD SATURATOR, or the CASED SATURATOR.

All Estimates given free for Lead Chemical Burning, and also Contracts for Sulphate Saturators.

Note Address—

20, SPRING GARDENS, BOLTON,

Lancashire.

Please write for Estimate before ordering elsewhere.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
8 Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

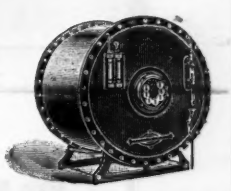
SEAHAM HARBOUR, COUNTY OF DURHAM.

JAMES MILNE & SON, LTD.,

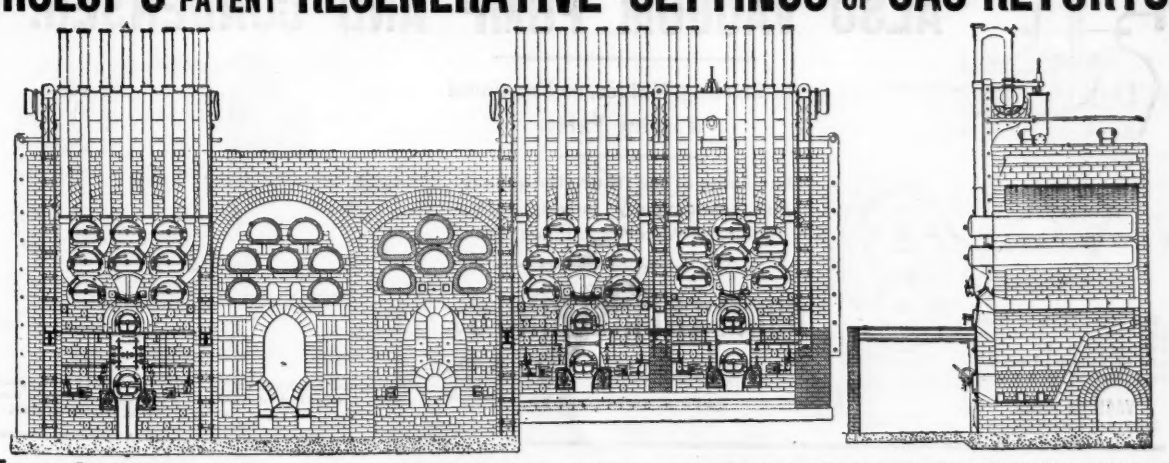
GAS ENGINEERS,

MILTON HOUSE WORKS, EDINBURGH.

LONDON. — GLASGOW. — LEEDS.



HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.

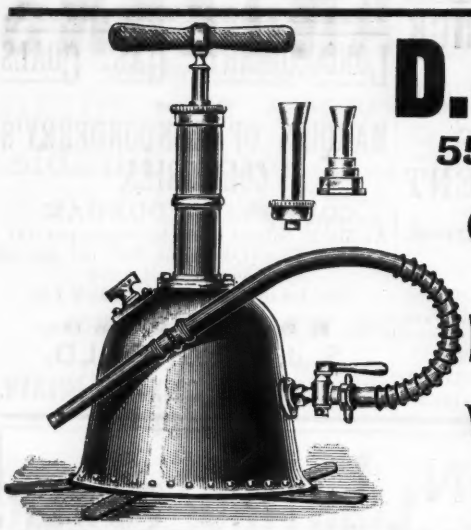
Further Information and Pamphlets from Principal Agent.

'680 SPIRIT

FOR ENRICHING COAL GAS,

As well as every other kind or grade of Liquid Hydrocarbons for same purpose are supplied by

S. BOWLEY & SON, Wellington Works, **BATTERSEA BRIDGE, LONDON, S.W.**



D. HULETT & CO., LTD.

55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

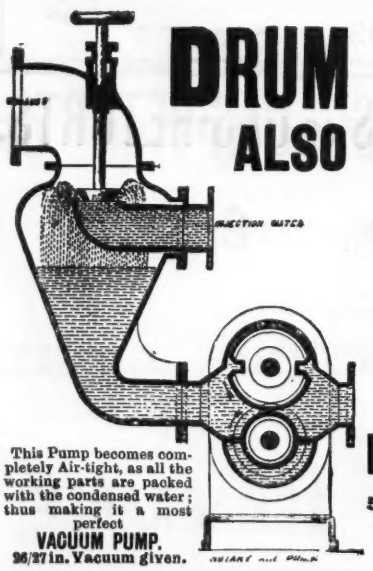
PRICE LISTS ON APPLICATION.

"The Force of the Piston Pump with the Capacity of the Centrifugal combined."

JOHNSON'S PATENT

DRUM PUMP AND EXHAUSTER

ALSO VACUUM PUMP AND CONDENSER.



This Pump becomes completely Air-tight, as all the working parts are packed with the condensed water; thus making it a most perfect

VACUUM PUMP.

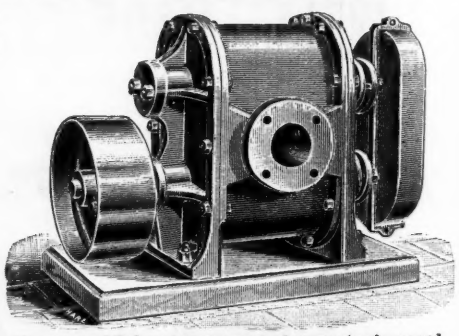
26/27 in. Vacuum given.

No Priming, Valves, or Frictional Working Parts.

The Pump of the future for quickly and economically moving large Bodies of Water, Semi-fluid, &c.

DRUM ENGINEERING Co.

55, ATHOL ROAD, BRADFORD.



Blowers and Exhausters guaranteed, even at a slow speed, to give a working pressure of 3 lbs. and upwards, and this without losing power by creating frictional Heat.

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FLAT-FLAME LANTERNS

From 30 to 800 Candle Power.

Made entirely of Copper. Best and most durable.

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CHEAP.

HANDSOME.

WELL MADE.

HIGH LIGHTING POWER.

SMALL CONSUMPTION OF GAS.

THE "BRAY" REFLECTING LIGHT.

SIMPLE.

CHEAP.

EFFICIENT.

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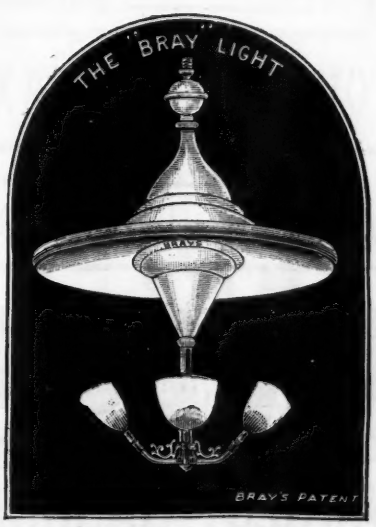

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ALSO THE LARGEST METAL TANK
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Belfast	1,700,000 ,,	Liverpool	2,500,000 ,,
Glasgow	300,000 ,,	Tottenham	600,000 ,,
Santiago	400,000 ,,	Brighton	1,250,000 ,,
Swansea	700,000 ,,	Bath	1,000,000 ,,

And have now under Contract:—

Belfast (Second Contract)	3,500,000 Cub. Ft.	Manchester	3,000,000 Cub. Ft.
Preston	1,500,000 ,,	New York	1,000,000 ,,
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CUTLER'S FREEZING PREVENTER IS THE BEST APPLIANCE FOR PREVENTING FORMATION OF ICE IN GASHOLDER CUPS, IT IS IN USE AT MANY IMPORTANT WORKS IN ENGLAND, GERMANY, AUSTRIA, AND AMERICA.

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BEST QUALITY.

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[See Illustrated Advertisement, Dec. 3, p. 1164.]

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WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

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SOCKET-PIPES FOR GAS OR WATER PURPOSES.

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The Climax of Regenerative Gas Lighting!!

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A 280-CANDLE POWER

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Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

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Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

THE PEEBLES PROCESS.

The Oil Gas Enrichment Company's Patents.

This Process for Enriching Coal Gas has now been adopted by nearly **50** Gas-Works at Home and Abroad, and continues to give complete satisfaction.

VERY LARGE PROFITS HAVE ACCRUED AT GAS-WORKS WHERE IT IS IN OPERATION; AND THE TROUBLE ARISING FROM NAPHTHALENE DEPOSITS HAS BEEN REMOVED.

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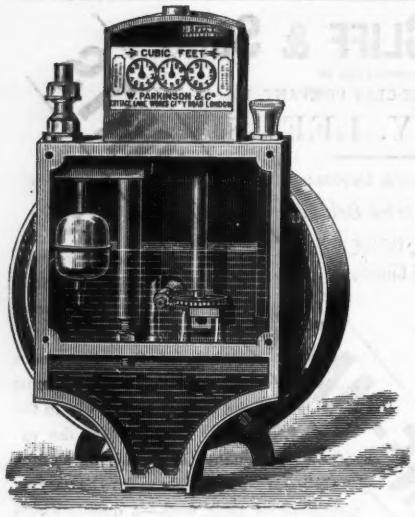
*** **Please note that our Advertisements will in future regularly appear in this space—viz., the inside of the last leaf of the JOURNAL—to facilitate reference by our customers.**

W. PARKINSON & CO.

OLDEST ESTABLISHED FIRM IN THE TRADE.



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IN CAST-IRON CASES.

Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.

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The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.

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[See also Advt. p. 1334.

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